



## COUNTY ADMINISTRATOR'S OFFICE

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C.H. HUCKELBERRY  
County Administrator

May 7, 2021

Colonel Julie A. Balten  
U.S. Army Corps of Engineers, Los Angeles District  
915 Wilshire Blvd, Suite 930  
Los Angeles, CA 90017-3489

Re: **Approved Jurisdictional Determinations, U. S. Army Corp of Engineers Permit SPL-2008-00816**

Dear Colonel Balten:

We have been informed that the U. S. Army Corps of Engineers (Corps) received a request on Hudbay's behalf to prepare an approved jurisdictional determination (AJD) for the Rosemont mine site in 2019.

In 2020, the U.S. Environmental Protection Agency (EPA) and the Department of Interior finalized the Navigable Waters Protection Rule (NWPR) to redefine "Waters of the US" for Section 404 of the Clean Water Act. The new rule excludes from federal jurisdiction all ephemeral streams and imposes a new standard for the Corps to find jurisdiction on any intermittent or perennial waterbodies that may exist upstream of Traditional Navigable Waters such as the Santa Cruz River, Gila River, or Colorado River.

In 2021, the Corps reached an AJD that removes federal jurisdiction over discharges to watercourses from the Rosemont mine project site based on the new NWPR. Such a decision is extremely consequential, not only to the parties to lawsuits against the development of the mine such as the tribes and non-profit corporation *Save the Scenic Santa Ritas*, but also to downstream land managers and owners such as Pima County and the Pima County Regional Flood Control District. It significantly affects the standards of care for discharge of pollutants to streams across a large area.

We have reviewed the March 24, 2021, Memorandum for the Record prepared by Michael Langley, Senior Project Manager for the Corps, and we have a number of significant concerns regarding this AJD and how the Corps performed the required analyses which call into question the legitimacy of the agency's decision. Specifically:

- The Corps' "typical year analysis" underpinning the AJD determination is fatally flawed in that it wholly relies on erroneous application of the "typical year" analysis, unsupported assumptions, and rejection of available data regarding "typical year" conditions.



Colonel Julie A. Balten, U.S. Army Corps of Engineers, Los Angeles District

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- The Corps erroneously rejected, contradicted, and ignored a plethora of available evidence supporting intermittency along Barrel Canyon within the analysis area.

These problems with the Corps' determination are further described in the attached memorandum.

Some of the litany of errors and omissions discussed in the attached memorandum may have been avoided if the Corps had completed the required coordination process with EPA. Based on an August 2020 Coordination Memorandum between the two agencies, EPA has every reason to expect that the Corps would coordinate the draft AJD and allow for review of any final AJD. Instead, we understand that no draft AJD was provided to EPA for their review. The Rosemont Copper Mine is a very high-profile project at the regional and even national levels, as evidenced by numerous lawsuits around important policy issues. The jurisdiction of the Clean Water Act in Pima County, in particular has been hotly contested for decades. Any AJD concerning the scope of the Clean Water Act at this mine could be expected to receive intense scrutiny.

Abrogating the process on such a high-profile project raises questions concerning the legitimacy of the process, especially when coupled with the seemingly willful rejection of available evidence supporting intermittency along Barrel Canyon and connectivity of flows from the Rosemont project site to the Santa Cruz River.

In light of the significant questions highlighted in the attached memorandum, Pima County and the Regional Flood Control District request reconsideration of the Corps' decision on this AJD.

Sincerely,



C.H. Huckelberry  
County Administrator

CHH/anc


Attachment

c: The Honorable Chair and Members, Pima County Board of Supervisors  
Deborah Jordan, Acting Administrator, Region 9, US Environmental Protection Agency  
Tomas Torres, Water Division Director, Region 9, U.S. Environmental Protection Agency



**Date:** May 5, 2021

**To:** C. H. Huckelberry, County Administrator

**Thru:** Linda Mayro, Director 

**From:** Julia Fonseca, Environmental Planning Manager

**RE: Rosemont Mine Approved Jurisdictional Determination, U. S. Army Corp of Engineers Permit SPL-2008-00816**

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On April 27, 2021 you asked that our office identify factual errors in the basis for Rosemont Approved Jurisdictional Determination. I have reviewed the Memorandum for the Record on U. S. Army Corp of Engineers Permit SPL-2008-00816 as it pertains to the “East area” of the Rosemont Copper Mine project area in light of the new Navigable Waters Protection Rule (NWPR) published in the Federal Register (Volume 85, No. 77, April 21, 2020). The Memorandum for the Record was prepared by Michael Langley, Arizona Branch, Los Angeles District, March 24, 2021, concerning the Approved Jurisdictional Determination (AJD) for the Rosemont Copper Mine Project. The project proponent is Hudbay Minerals. I report my findings below.

**1. The Corps’ “typical year analysis” underpinning the AJD determination is fatally flawed.**

***The Corps’ determination rests on erroneous application of the “typical year” analysis.***

The approved jurisdictional determination (AJD) for the Rosemont mine site rests entirely on erroneous application of the Navigable Waters Protection Rule (NWPR) requirements for a “typical year” analysis. In performing its analysis for this AJD, the U.S. Army Corps of Engineers (Corps) impermissibly narrowed the scope of its analysis to a single day – December 2, 2020 – when it was not raining.

Under the NWPR, determining the jurisdictional status of an intermittent or perennial waterbody is generally informed by understanding conditions in a “typical year” – i.e., the normal periodic range of precipitation and other climactic variables for that waterbody. “Typical year” is a term that ensures the agencies are considering normal hydrologic flows or surface water connections that occur under normal conditions, rather than making important decisions based on conditions that are abnormally wet or dry. The term is meant to provide a standard context for using information and interpreting field observations and methods, remote sensing data and imagery, and various models that inform an AJD. Using a single day to determine what conditions are in a “typical year” is an egregious misapplication of the standard.

Agencies determine the “normal” conditions for an area by considering 30 years of data on precipitation, drought and other climatic factors for a given location. Normal precipitation, drought, and other climatic conditions should be determined based on the most accurate long-term data for a given waterbody (e.g., data continuously collected at nearby, representative weather monitoring stations).

The Corps’ reportedly chose December 2, 2020 because it was a date it knew that surface water existed in two of the three waterbodies it studied on that date (Memorandum at page 11). However, the Corps recognized that the Palmer Drought Severity Index for December 2, 2020 was “extreme drought” and the



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most recent rain event had occurred about three weeks prior to that date. The Corps also acknowledged that field observations of waterbodies in the Rosemont area are few in number. Despite these acknowledgements, the Corps limited its analysis to intermittent flow lengths as observed during this single field day, without any consideration as to whether runoff during normal climatic conditions might link the three waterbodies with the Santa Cruz River.

The NWPR requires consideration of surface water flow directly and indirectly in a typical year. The Federal Register Volume 85, Number 77 (NWPR) states on page 22295 that *"in some geographic areas, intermittent streams may typically flow only at certain times, such as during seasonally wet conditions. Thus, the agencies would not expect to observe streamflow in seasonally dry conditions, even if precipitation during those dry conditions is considered typical for the dates of interest."*

The lack of flow or surface water connection during abnormally dry periods does not mean that a waterbody is not jurisdictional. Here, the Corps impermissibly restricted its analysis to a condition whereby groundwater-dependent streams and springs must be shown to link to the Santa Cruz River during drought, and in absence of runoff. Under these assumptions, no distant spring-fed waterbody will ever survive the typical year analysis to link the Santa Cruz River during any time of the year. By restricting its analysis in this way, the Corps has failed to meet its responsibilities under NWPR.

This approach is even more puzzling when considering the Corps' cited TetraTech (2016) memorandum, which establishes that a hypothetical one-year rainfall event falling only on the project area is projected to flow a distance of 14.6 miles beyond the project area.

***The Corps rejected EPA's "typical year" analysis based on an unsupported assumption.***

In addition, the Corps ignored other data provided by the U. S. Environmental Protection Agency (EPA) that supports federal jurisdiction for the waterbodies at issue. The NWPR requires an examination of stream connectivity relative to a "typical year" analysis. EPA performed that analysis for four dates and found evidence of flow connectivity between the lower Barrel Canyon stream gage at State Route 83 and the Traditionally Navigable Water along the Santa Cruz River downstream of Tucson. (Attachment 1). EPA's analysis was dated November 11, 2020, and examined not only USGS stream gage data for Barrel Canyon, but also stream gages located along Davidson Canyon, Cienega Creek, Pantano Wash, Rillito Creek and the Santa Cruz River, most of which are operated by Pima County Regional Flood Control District (RFCD).

The Corps dismissed the EPA analysis, saying "a typical year analysis is only needed for the three non-ephemeral features in the East area review area." This rejection rests on a baseless assumption that none of the intermittent waterbodies present in the Rosemont project area would have contributed flow during the four events in the EPA analysis. The Corps presents no evidence to support this assumption.

Indeed, the Corps reviewed various dates and resolutions of aerial imagery, which provides evidence of connectivity during floods, including patterns of sediment that indicate the non-ephemeral features are linked to downstream waters via ordinary tributary flows. The Corps declined to cite anything evident in the imagery that would prevent surface flows from connecting the waterbodies to the downstream gage.



The NWPR further states on page 22295 that *“evidence of recent flow can be observed through the presence of multiple or abundant signs of certain ordinary high water mark indicators for the region...”* None of the WestLand Resources data referenced supports factors that would isolate these waterbodies from the downstream gage during runoff events. Further, TetraTech (2016), cited by the Corps, establishes that runoff would be expected to flow 14.6 miles from the project site during a 1-year, 24-hour rainfall event.

Flow connectivity between the three waterbodies and the Barrel Canyon gage on the four dates analyzed by EPA was not rejected for any rational reason expressed in the Corps’ Memorandum. Flow connectivity should be examined during normal conditions of runoff, as opposed to the lack of runoff and extreme drought condition which prevailed during the one date selected for analysis by the Corps.

***The Corps ignored evidence of flow connectivity from the Rosemont Project site to the Santa Cruz River when conducting the “typical year” analysis.***

The Corps knew of the RFCD gage data at least by the time EPA provided their analysis. Even if the Corps rejected EPA’s data, they should have independently reviewed RFCD gage data for the Corps’ assessment of flow connectivity in a typical year.

Independent of the EPA analysis, Pima County Regional Flood Control District (RFCD) analyzed flow connectivity between Barrel Canyon and the Santa Cruz River in January 2021 using eight U.S. Geological Survey (USGS) and RFCD stream gages also referenced in EPA’s analysis (Attachment 2).

RFCD’s analysis is bolstered by radar-based precipitation estimates. RFCD’s analysis takes into account the fact that its sensors are not positioned in the lowest part of the channel invert and small flows may escape detection by the sensor.

With this consideration in mind, 11 potentially connective runoff events were identified for Barrel Canyon on the following dates: 9/24/2019, 8/10/2019, 9/19/2018, 7/23/2017, 7/20/2017, 8/2/2016, 7/31/2016, 9/3/2015, 7/12/2014, 7/30/2010. These dates include three of the four used by EPA in its analysis. Palmer Drought Severity conditions for these events range from Extreme Drought to Moderately Moist.

**2. The Corps erroneously rejected, contradicted, and ignored a plethora of evidence supporting intermittency of stream flow along Barrel Canyon within the analysis area.**

Even if the upstream water bodies were not connected, lower Barrel Canyon has an intermittent stream reach located in the Rosemont project area, which the Corps’ analysis has erroneously rejected.

***The Corps rejected Pima County’s intermittent stream mapping based on an erroneous assumption.***

The lowest reach of Barrel Canyon Wash was mapped by Hudbay as an ephemeral feature, but it is mapped by Pima County as having an intermittent flow regime along an approximately 1,200-foot reach upstream from the State Route 83 (SR83) bridge at the site boundary. The Corps recognizes that certain intermittent or perennial waterbodies exist in the mine site, but has consistently rejected – without evidence – the premise that any portion of Barrel Canyon on the project area is intermittent.



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The Corps' Memorandum at page 7 states that "it appears this [Pima County] designation is based on anecdotal accounts of pooled water found in the vicinity of a USGS stream gage located near the highway bridge and the presence of algae..."

This assumption is simply incorrect, as our mapping of intermittent flow reaches on Barrel Canyon is not based on anecdotal reports of pooling at the bridge culvert, but was instead derived from comprehensive inventory fieldwork conducted during 1999 and 2000, long before the Rosemont mine project was proposed. The work was done by Pima Association of Governments (PAG 2000), not Pima County. In fact, on November 30, 2020, EPA sent the link to the report to the Corps, so the agency should have understood and acknowledged the methods used; there is no justification for assuming it was based on anecdotal info.

For this report, PAG's responsibility was to map the upstream and downstream endpoints of intermittent and perennial flows for streams in Pima County. For a stream reach to be included in the coverage, PAG required "reliable documentation that the location met the definition of perennial or intermittent." The report's methodology was robust and included compiling agency data, reviewing USGS maps and aerial photography, groundwater level data, stream gage data, satellite imagery and miscellaneous literature, as well as field visits. A panel of subject matter experts including Arizona Department of Environmental Quality, RFCD, and the University of Arizona's Hydrology Department helped PAG identify criteria for inclusion, collected additional information and vetted the results. Based on field observations by a PAG hydrologist in September and October 1999, PAG determined that Barrel Canyon has intermittent flow (PAG 2000).

The proper characterization of flow along Barrel Canyon is important because the lowest intermittent or perennial waterbody within the applicant's defined project area defines the Corps' starting point for "typical year" analysis. If Barrel Canyon is intermittent at the bridge, then there would be no need for the Corps to show connectivity between upstream springs and streams. Instead the Corps would simply begin its analysis at the (USGS) stream gage located at the SR83 bridge.

***The Corps' interpretation of disrupted flow at the bridge contradicts available evidence.***

Proceeding from the unfounded and incorrect assumption about Pima County's flow regime classification, the Corps concludes: "Even though there is anecdotal evidence of wetter conditions in the portion of this stream immediately upstream from the SR83 bridge, this is not supportive of a determination the flow regime is non-ephemeral with a connection to groundwater. The wetter conditions appear to be caused by the disruption of flow within this stream from the bridge structures."

This conclusion is incorrect and is directly contradicted by the available evidence. First, direct field observation by PAG hydrologists is not anecdotal evidence and to characterize it as such is disingenuous at best. More importantly, available evidence clearly shows that disruption of flow by the bridge is not what created the flowing reach observed by PAG's hydrologist in September and October 1999, and by USGS hydrologists servicing the gage thereafter.

To support its conclusion that bridge structures caused the flow disruption, the Corps cites as evidence a technical memorandum by WestLand Resources dated December 28, 2020, which describes conditions as they existed on December 22, 2020 when WestLand's staff visited the site. The WestLand report was requested by the Corps on December 18, 2020, specifically to "determine the nature of its flow regime." A biologist from WestLand conducted a site visit on December 22, 2020 to collect "photographs of the Barrel



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Canyon channel immediately upstream and downstream of the bridge” and to list “all identifiable plants located between the tops of the banks of the wash from the bridge upstream to a point approximately 500 feet upstream from the bridge.” The WestLand memorandum noted the presence of dried algae, which is a legitimate field indicator of intermittent flows.

Describing the WestLand memorandum’s findings, the Corps states, “the memorandum confirms that the bridge structure and associated concrete aprons beneath the bridge tend to *slow down* flow within the wash and that erosion along the edges of the concrete structures serve to *potentially allow retention/ponding* of water during and after flow events in the immediate vicinity of the bridge and the stream gage, which is located near the bridge.” (Emphases added.)

However, the WestLand memorandum does not draw this conclusion. In fact, it draws no conclusion regarding disruption or retention of flow at the bridge, nor is any photographic evidence provided for retention of flow upstream of the gage during or after flow events. Instead, the Corps relied entirely on unsupported speculation to manufacture this conclusion.

In fact, available evidence directly refutes the Corps’ unfounded speculation. Photographs at WestLand Observation Point 2-1 and 2-2 show a positive downstream slope exists from the stream bed across the bottom of the concrete box culverts, ending with a drop of over a foot at the concrete apron at Observation Point 1-1. The stream bed deposits are sand and gravel, suggesting high velocities are maintained across the bottom of the concrete box culvert. No records of log jams are present, and there is no mud to suggest the box culvert impounds flow or substantially reduces flow velocities. Based on this evidence, a far simpler explanation for the algae is the persistence of flows upstream of the bridge.

The photographs included here and all the other photographs in the WestLand memorandum directly contradict the Corps’ highly dubious assertion that water retained at the bridge is responsible for the dried algae observed by WestLand Resources staff along the wall of the culvert. That the Corps could come to this conclusion in direct contradiction of all available evidence points to apparent bias and calls for a reconsideration of their determination.



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**Figure 1. Observation Point 1-1 Photograph by WestLand, looking upstream across concrete apron from a position downstream of the USGS gage. December 22, 2020.**



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Figure 2. Observation Point 2-2. Looking downstream across northern box culvert. No scour holes or evidence of retained flow in the culvert to account for the dried algae observed by WestLand on northern wall downstream of the white staff gage. Note coarseness of the sediment being transported by flows. December 22, 2020, photo by WestLand.



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**Figure 3. Observation Point 2-1. Northern box culvert looking upstream. Note lack of obstructed flow, scour holes or other evidence of retained flow upstream. WestLand report notes dried algae on northern wall. December 22, 2020, WestLand photo.**



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**Figure 4. Observation Point 2-2. Showing dried algae noted by WestLand along base of the northern wall of the box culvert. Note presence of gravel, which is inconsistent with the assumption that retained flow is responsible for growth of algae or intermittent flow. December 22, 2020, WestLand.**



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***The Corps ignored additional photographic evidence showing unobstructed, persistent flows and algae.***

The algae observed by WestLand is evidence of intermittent flow; similar evidence is readily available but was ignored by the Corps so we provide it here. For example, Figure 5 shows unobstructed flow exists at the gage location on Barrel Canyon during U. S. Geological Survey's field visit of September 4, 2015.



**Figure 5. Barrel Canyon box culvert looking downstream, note positive flow and lack of evidence for retained or impounded flow. USGS gage at left, photograph by USGS, September 4, 2015, the same date that rainfall occurred at this site.**



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Figure 6 shows unobstructed flow at the USGS gage site on Barrel Canyon, five days after the last rain measured. Note evidence of algae in bed of stream just upstream of the gage and water clarity. Note gravel. Photograph was taken by USGS staff during a field visit on October 14, 2015.



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**Figure 7 shows wetted stream bed with positive drainage and no evidence of retained flow upstream of the stream gage along Barrel Canyon in 2016. The camera date/time was mis-set to read 2015 (E. McGuire, personal communication in Pima County 2017).**

Figure 7 is a photograph by USGS staff during a field visit on January 25, 2016, 14 days after the last significant rainfall measured at the site. (0.01 inch fell January 16, 2016.) This intermittent base flow is the cause of prolonged surface water observations at the gage, not pooled water.



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**Figure 8 shows algae at the USGS stream gage. Note clarity of base flow and wetted sediment.**

Mr. Emmett McGuire also said of Figure 8: "The photo does show algae in a pool of water surrounding the pressure transducer tip. I have noticed *algae growing in the wetted channel* during other visits as well." [Emphasis added.]

The Corps response is to call observations of algae either "anecdotal" or the result of "pooled water" at the gage, whereas USGS staff notes the algae grows in the wetted channel. Figure 7 clearly shows upstream base flows observed contemporaneously with the algae and water observed in Figure 8. Algae grows in sunlight and in January, the culvert is dark most of the time. Any algae here on this date is not the result of a stagnant and isolated pond.



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Figure 9 shows streambed wetted by persistent flow upstream of the stream gage along Barrel Canyon during a field visit on February 4, 2015, two days after last rainfall. No evidence of retained floodwater or disruption by the bridge. Photograph by USGS.

***The Corps ignored hydrographic evidence for persistent flows at the USGS gage.***

Figures 6-9 provide visual evidence of persistent, intermittent flows documented in the gage data that the Corps failed to review. There is no evidence that the agency examined any of the USGS' site photographs for corroborating evidence at the Barrel Canyon gage, let alone reviewing contemporaneous USGS field measurements of base flows for evidence of intermittency. Examination of USGS hydrographs of flow events from the gage can also be instructive and are readily available; these can be generated online. For example, Figure 9 shows small flows persisted for several weeks in February and March of 2019.



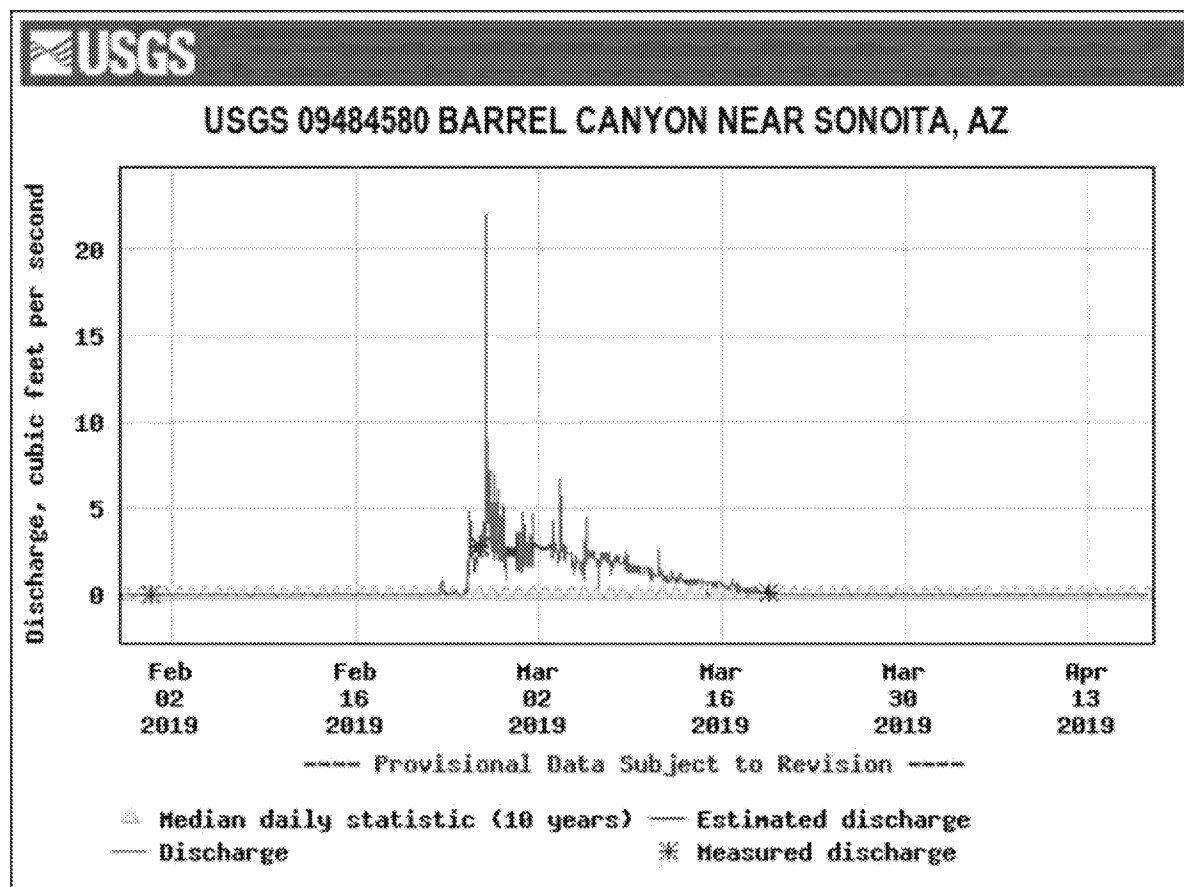


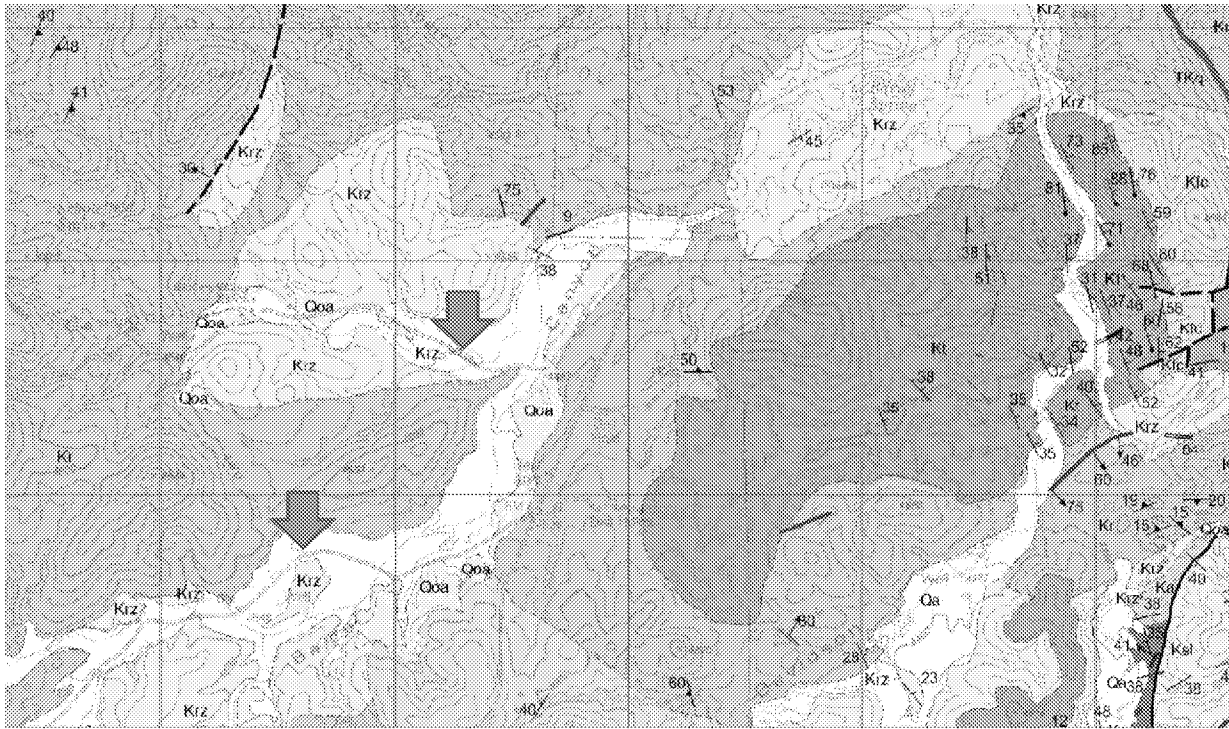
Figure 10. Persistent flows at the USGS gage at SR83 in February-March 2019. Red dates are field measurements of flow by USGS, to verify the gage recordings.

Sharp, short duration peak of over 20 cubic feet per second (cfs) is characteristic of direct runoff. This is superimposed on a long “tail” of base flows ranging from three or fewer cubic feet per second lasting several weeks. These lower, persistent discharges are characteristic of intermittent flows. Barrel Canyon is an undammed stream, and the Corps has provided no alternative evidence for upstream regulation or impoundment of flow that could cause these effects.

***The Corps ignored hydrogeologic conditions that are favorable for intermittent flow.***

The Corps relied on disruption of flow at the bridge to account for persistent base flows and algae observed at the USGS gage. This interpretation ignores the hydrogeologic context of the Rosemont project setting.





**Figure 11. Geologic map of the northern part of the Empire Ranch 7 ½ minute quadrangle, Pima County, Arizona, by C. A. Ferguson, 2009. Arizona Geological Survey Open-Filed Report 09-05, version 1.0. Blue arrows added to emphasize bedrock outcrops surrounded by sediment.**

This geologic map supports an interpretation of what hydrologists sometimes call a “shoestring aquifer” of Quaternary alluvium overlying bedrock of Cretaceous (K) age. Shoestring aquifers are narrow “strings” of loose sediment surrounded by bedrock, usually corresponding with the boundaries of the geologic floodplain. Because of their small size, they can quickly fill and drain. In Figure 11, sediment, as known as alluvium, is shown in yellow. The other colors are bedrock. Note the occurrence of small green Cretaceous (Krz) outcrops surrounded by the yellow alluvium in Scholefield and Barrel Canyons upstream of the SR83 highway crossing. The arrows show bedrock “peeking” through thin sediment. Even more important, the geologic map shows that yellow alluvium is absent just downstream of the highway; here the stream flows over a mass of green and pink color representing bedrock. This is the end of the “shoestring”.

In fact, bedrock lies only eight feet below land surface at the Hudbay monitor well located approximately 0.3 miles upstream of the USGS gage on Barrel Canyon (Figure 12), and bedrock outcrops just downstream of the USGS gage (Figure 13). Intermittent flow likely occurs when the shallow alluvial cover is sufficiently saturated upstream of the big green mass of bedrock, much like water spilling over the lip of a cup.



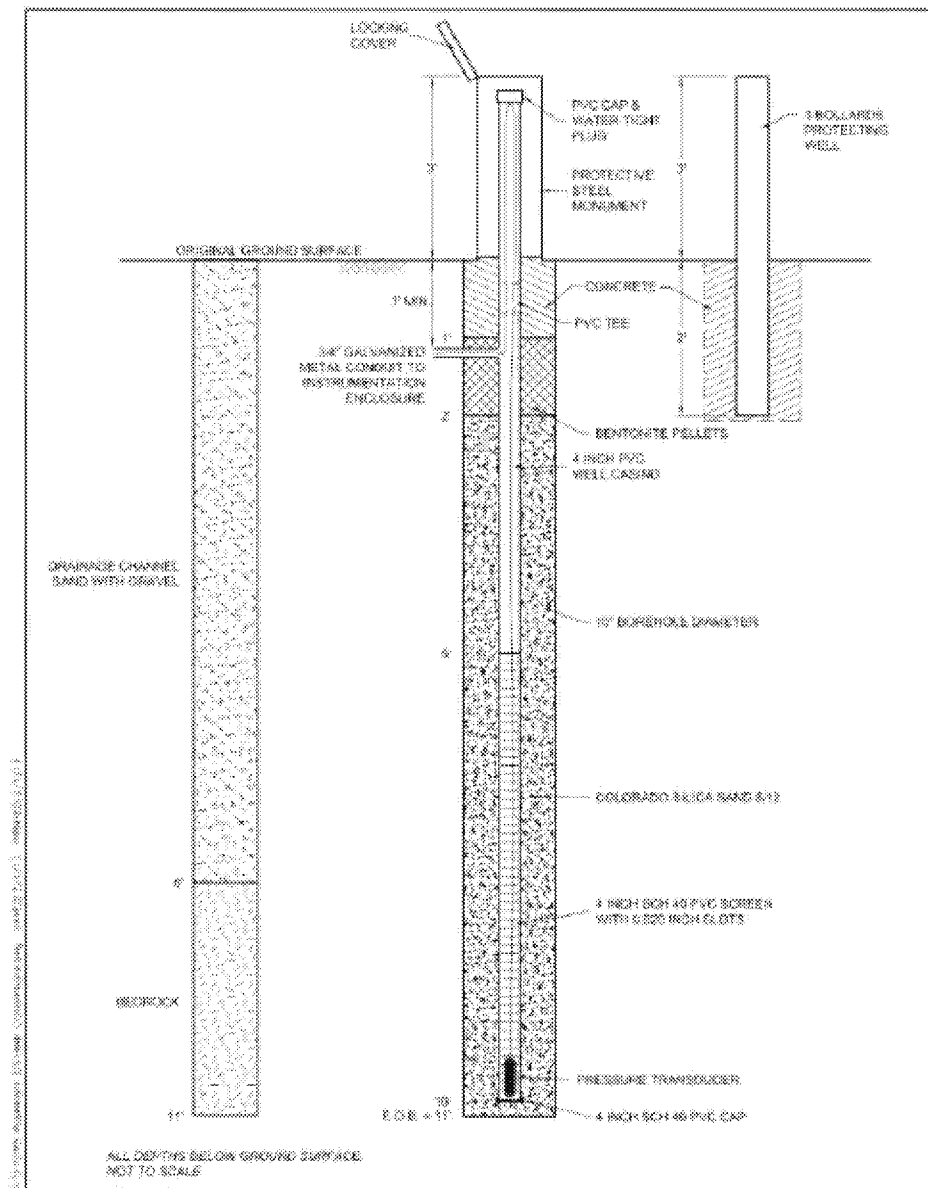


Figure 4. Barrel Canyon well BC-2A-GW lithology and well completion.

February 2013

Figure 12. Drill log of alluvium over bedrock encountered at Huidbay monitor well BC-2A, the alluvial piezometer, figure from m Hydro-Logic (2013).



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**Figure 13. View of two bedrock outcrops looking downstream from the SR83 box culverts. August 16, 2017. Photograph by Julia Fonseca, Pima County.**

While the Corps' Memorandum acknowledges the intermittent flows and spring discharge exists downstream of the gage, the Corps dismisses the flows downstream of the gage as irrelevant to the review area. On the contrary, the bedrock outcrops downstream are essential for understanding the hydrogeologic context. PAG (2000) intermittent stream flow mapping extends both upstream and downstream of this location. While intermittent flows persist longer at Barrel Spring downstream of the gage, they do also occur upstream in the shallow alluvium from time to time.

Barrel Canyon is one intermittent flow reach that has been subjected to a bifurcated analysis by the federal agencies (Figure 14).



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***The Corps erroneously dismissed bank storage flows observed by WET (2017) at BC2.***

The Corps has not refuted evidence provided by Hudbay contractor Water and Earth Technologies (WET) of intermittent flow upstream of the stream gage on SR 83. The Corps' analysis simply dismissed them as irrelevant.

The Pima County Administrator's letter to the Corps dated October 18, 2018, provided additional data, including data from Hudbay contractor WET (2017) that show that flow persists at the alluvial monitoring station BC2 for several days or weeks following large runoff events. Despite the ongoing drought, WET wrote:

"At some Rosemont stations, bank storage flows has been observed as flowing water not directly attributed to precipitation events. At some Rosemont stations, bank storage flow is often very low flows of the trailing limb of hydrographs (e.g., <1.0 cfs) that persists for several days or weeks following large runoff events. Bank storage flows have been observed at station RS-MC-3 and to a lesser extent at stations RS-SC-4 and RS-BC-2."

By definition, anything that is bank storage is characteristic of intermittent or perennial streams because it is not associated with storm events.

The Corps Memorandum offers no evidence supporting an alternative explanation to persistent flows on Barrel Canyon station BC2; instead, it rejects evidence of intermittent flow because WET's report "was provided to look at broader project issues being evaluated at the time related to perceived potential degradation of water quality and flows within the larger watershed. These issues are not relevant to the current AJD actions."

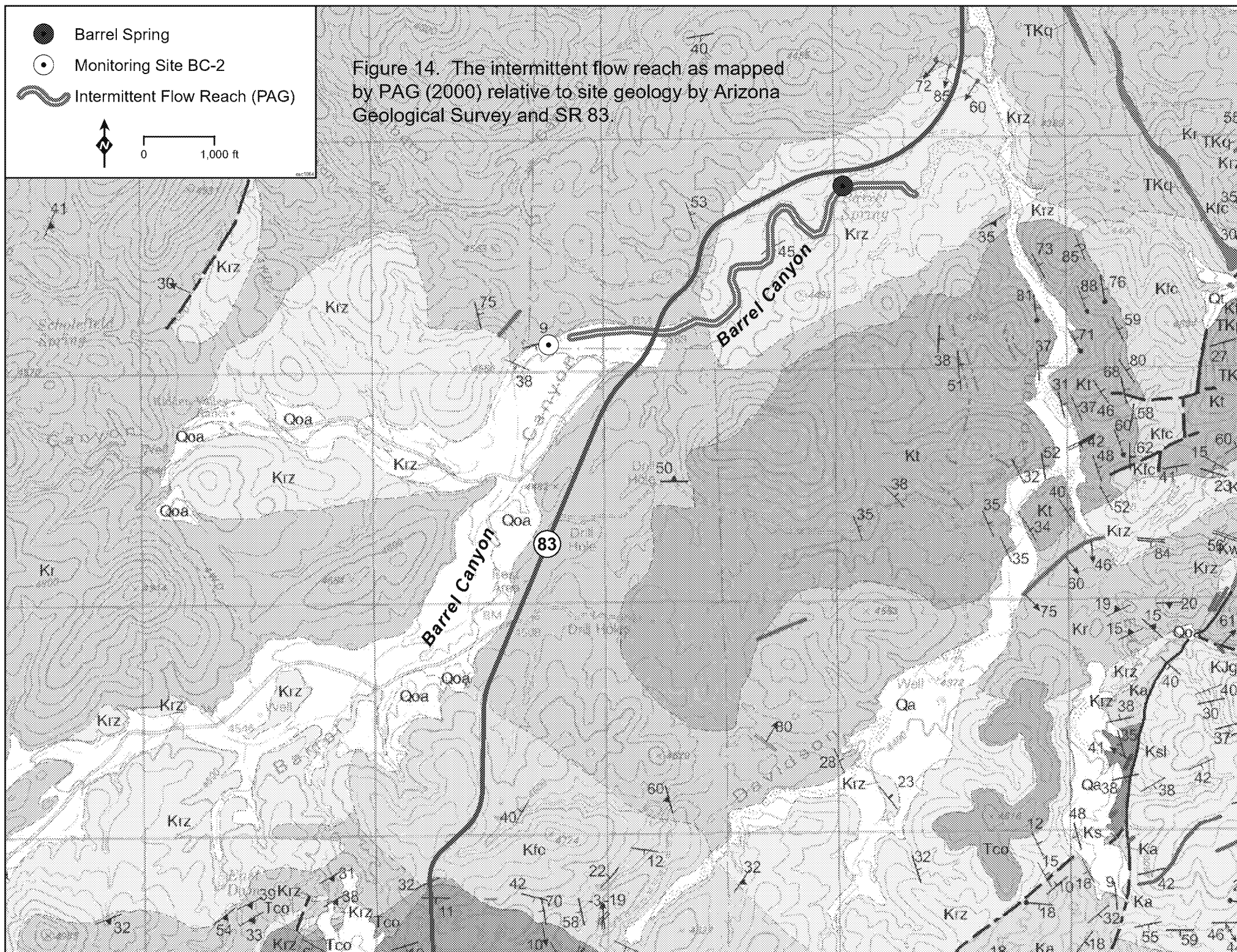
***The Corps' statement regarding near-surface groundwater contradicts available evidence.***

According to the Corps, "Groundwater data for this review area does not indicate any areas of near-surface groundwater elevations that could support a wetter flow regime."

This is contradicted by available evidence, specifically a January 16, 2015 memorandum prepared by Hudbay (2015e) that shows the depth to water in the alluvial well at BC2 on the dates measured in 2014 varied from 0 to 2.55 ft. According to a 2014 analysis of Barrel Canyon and Davidson Canyon Instrumentation data, the groundwater level in December 2013 was around 2 feet (WET 2014). The construction log for the alluvial well is shown in Figure 11.

These data from Hudbay contractors support an interpretation that intermittent flow in Barrel Canyon upstream of the gage can result when the thin alluvium overlying the bedrock is sufficiently saturated. Even when groundwater is not observed at BC-2, there may be groundwater in the floodplain sediments; the alluvial cover is eight feet at the well and the well is positioned at the edge of the shoestring aquifer, which is likely not the deepest point. Groundwater flowing below the surface of the channel would be discharged where the floodplain aquifer drains over the bedrock outcrop located just downstream of the gage (Figure 12). While evidence of groundwater is not required for an intermittent flow determination, it is present in the Corps' analysis area.







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The fact that groundwater is present in the stream channel 0.3 mile upstream of the culvert, the fact that bedrock is observed below the channel at shallow depth, that fact that USGS observes the wetted channel upstream of the gage to provide persistent flow and algae, the fact that Hudbay's own consultants identified persistent "bank storage flows", the fact that PAG hydrologists mapped intermittent flow extending at times from upstream of the gage to the Barrel Spring downstream, all of these lines of evidence support the interpretation that this is an intermittent stream reach.

***The Corps ignored botanical evidence that supports intermittency on Barrel Canyon.***

Stream intermittency is consistent with field observations of seepwillow (*Baccharis salicifolia*) and netleaf hackberry (*Celtis reticulata*) by WestLand (2020) in the channel of Barrel Canyon within 500 feet upstream of the gage. Seepwillow and hackberry often occur along intermittent and perennial streams in Pima County (PAG 2000). In my experience, where these plants occur in otherwise dry-looking streams, there is often bedrock or some other restricting layer below the stream bed, in the root zone.

While no wetland obligate plant species were observed in the survey, both USGS (various years) and WestLand (December 2020) photographs show the stream reach is heavily grazed and trampled by livestock. This land use factor should have been considered by the Corps when interpreting the botanical evidence.

***3. The Corps ignored available data regarding intermittent water bodies and additional dates of water observations in the project area.***

Additional evidence for water bodies both inside and outside the Corps' analysis area is found in the EIS record within Hudbay (2015e). This record shows additional dates when water was present at Rosemont Spring, MC-2, and other intermittent springs, independent of the WestLand data relied on by the Corps. For instance, McCleary Dam flow was measured 43 times between 2008 and 2013, including dates in May and June.

**Attachments:**

- A. EPA analysis of stream gage data
- B. RFCD analysis of stream gage data

**References**

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<https://www.rosemonteis.us/sites/default/files/references/048930.pdf>



To: C. H. Huckelberry, County Administrator

**Subject: Rosemont AJD**

Date: May 5, 2021

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Pima Association of Governments 2000. GIS Coverage of Perennial Streams, Intermittent Streams and Areas of Shallow Groundwater. Final Project Report. Prepared for Pima County Sonoran Desert Conservation Plan. Accessed April 29, 2021 at <http://www.pima.gov/cmo/sdcp/reports/d7/002GIS.PDF>

Pima County 2017. Letter to William James and Kerwin Dewberry from County Administrator Huckelberry. New information: Rosemont Copper Mine, Section 404 Clean Water Act. September 28, 2017

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WestLand Resources 2020. Rosemont Approved Jurisdictional Determinations: Response to ACOE Request for Information Regarding Lower Barrel Canyon. December 28, 2020.



## ATTACHMENT A: EPA ANALYSIS OF GAGE DATA



11/20/2020

Gauge #	Gauge Name	Latitude	Longitude
9484580	Barrel Canyon near Sonoita, AZ	31.86167	-110.69056
4313	Davidson Canyon Wash above I-10	31.99358	-110.64513
4253	Pantano Wash near Vail (Pantano Dam)	32.03611	-110.67667
9484600	Pantano Wash near Vail, AZ	32.03583	-110.67694
4263	Pantano Wash at Schist	32.04327	-110.69001
9485450	Pantano Wash at Broadway Blvd. at Tucson, AZ	32.22056	-110.82889
2353	Rillito Creek above Dodge Blvd.	32.27114	-110.91171
9485700	Rillito Creek at Dodge Blvd. at Tucson, AZ	32.27139	-110.91389
9486055	Rillito Creek at La Cholla Blvd. near Tucson, AZ	32.30333	-111.01139
2363	Rillito Creek at La Cholla Blvd	32.30269	-111.01144
6013	Santa Cruz River below Canada del Oro Wash	32.32816	-111.06856

Gauge #	Gauge Name	Latitude	Longitude	Date	Peak Flow (cfs)	Flow Preceding and Following Day	APT Condition (Score)	Palmer Drought Index
9484580	Barrel Canyon near Sonoita, AZ	31.86167	-110.69056	9/19/2018	1.18 (mean)	No	Drier-than-Normal (-8)	Normal
4313	Davidson Canyon Wash above I-10	31.99358	-110.64513	9/19/2018	2,260	No	Normal (-13)	Normal
4253	Pantano Wash near Vail (Pantano Dam)	32.03611	-110.67667	9/19/2018	5,622	Yes	Normal (-13)	Normal
9484600	Pantano Wash near Vail, AZ	32.03583	-110.67694	9/19/2018	546 (mean)	Yes	Normal (-13)	Normal
4263	Pantano Wash at Schist	32.04327	-110.69001	9/19/2018	4,254	F	Normal (-13)	Normal
9485450	Pantano Wash at Broadway Blvd. at Tucson, AZ	32.22056	-110.82889	9/18/2018	237 (mean)	F	Drier-than-Normal (-9)	Normal
2353	Rillito Creek above Dodge Blvd.	32.27114	-110.91171	9/19/2018	2,858	Yes	Normal (-13)	Normal
9485700	Rillito Creek at Dodge Blvd. at Tucson, AZ	32.27139	-110.91389	9/20/2018	164 (mean)	F	Normal (-13)	Normal
9486055	Rillito Creek at La Cholla Blvd. near Tucson, AZ	32.30333	-111.01139	9/20/2018	179 (mean)	Yes	Normal (-11)	Normal
2363	Rillito Creek at La Cholla Blvd	32.30269	-111.01144	9/20/2018	1,584	Yes	Normal (-11)	Normal

Gauge #	Gauge Name	Latitude	Longitude	Date	Peak Flow (cfs)	Flow Preceding and Following Day	APT Condition (Score)	Palmer Drought Index
9484580	Barrel Canyon near Sonoita, AZ	31.86167	-110.69056	9/3/2015	528	Yes	Normal (-10)	Incipient Wetness
4313	Davidson Canyon Wash above I-10	31.99358	-110.64513	9/3/2015	1,510	Yes	Normal (-14)	Incipient Wetness
4253	Pantano Wash near Vail (Pantano Dam)	32.03611	-110.67667	9/3/2015	1,400	Yes	Normal (-14)	Incipient Wetness
9484600	Pantano Wash near Vail, AZ	32.03583	-110.67694	9/2/2015	1,580	Yes	Normal (-14)	Incipient Wetness
4263	Pantano Wash at Schist	32.04327	-110.69001	9/3/2015	1,220	Yes	Normal (-14)	Incipient Wetness
9485450	Pantano Wash at Broadway Blvd. at Tucson, AZ	32.22056	-110.82889	9/3/2015	1,510	Yes	Normal (-12)	Incipient Wetness
2353	Rillito Creek above Dodge Blvd.	32.27114	-110.91171	9/3/2015	1,547	Yes	Normal (-12)	Incipient Wetness
9485700	Rillito Creek at Dodge Blvd. at Tucson, AZ	32.27139	-110.91389	9/4/2015	1,380	Yes	Normal (-12)	Incipient Wetness
9486055	Rillito Creek at La Cholla Blvd. near Tucson, AZ	32.30333	-111.01139	9/4/2015	146	Yes	Drier-than-Normal (-9)	Incipient Wetness
2363	Rillito Creek at La Cholla Blvd	32.30269	-111.01144	9/3/2015	211	Yes	Drier-than-Normal (-9)	Incipient Wetness



Gauge #	Gauge Name	Latitude	Longitude	Date	Peak Flow (cfs)	Flow Preceding and Following Day	APT Condition (Score)	Palmer Drought Index
9484580	Barrel Canyon near Sonoita, AZ	31.86167	-110.69056	9/9/2011	1,780	F	Normal (-10)	Severe Drought
4313	Davidson Canyon Wash above I-10	31.99358	-110.64513	9/10/2011	1,510	P	Normal (-10)	Severe Drought
4253	Pantano Wash near Vail (Pantano Dam)	32.03611	-110.67667	NA	NA	NA	NA	NA
9484600	Pantano Wash near Vail, AZ	32.03583	-110.67694	9/10/2011	262 (mean)	Yes	Drier-than-Normal (-8)	Severe Drought
4263	Pantano Wash at Schist	32.04327	-110.69001	NA	NA	NA	NA	NA
9485450	Pantano Wash at Broadway Blvd. at Tucson, AZ	32.22056	-110.82889	9/10/2011	405 (mean)	F	Normal (-11)	Severe Drought
2353	Rillito Creek above Dodge Blvd.	32.27114	-110.91171	9/10/2011	1,090	Yes	Drier-than-Normal (-8)	Severe Drought
9485700	Rillito Creek at Dodge Blvd. at Tucson, AZ	32.27139	-110.91389	9/10/2011	6,060	Yes	Drier-than-Normal (-7)	Severe Drought
9486055	Rillito Creek at La Cholla Blvd. near Tucson, AZ	32.30333	-111.01139	9/10/2011	7,340	Yes	Drier-than-Normal (-7)	Severe Drought
2363	Rillito Creek at La Cholla Blvd	32.30269	-111.01144	9/9/2011	203	Yes	Drier-than-Normal (-7)	Severe Drought

Gauge #	Gauge Name	Latitude	Longitude	Date	Peak Flow (cfs)	Flow Preceding and Following Day	APT Condition (Score)	Palmer Drought Index
9484580	Barrel Canyon near Sonoita, AZ	31.86167	-110.69056	7/29/2010	50 (mean)	F	Normal (-14)	Mild Drought
4313	Davidson Canyon Wash above I-10	31.99358	-110.64513	7/30/2010	2,820	Yes	Normal (-13)	Moderate Wetness
4253	Pantano Wash near Vail (Pantano Dam)	32.03611	-110.67667	NA	NA	NA	NA	NA
9484600	Pantano Wash near Vail, AZ	32.03583	-110.67694	7/30/2010	4,230	Yes	Normal (-10)	Moderate Wetness
4263	Pantano Wash at Schist	32.04327	-110.69001	NA	NA	NA	NA	NA
9485450	Pantano Wash at Broadway Blvd. at Tucson, AZ	32.22056	-110.82889	7/30/2010	4,690	Yes	Normal (-13)	Moderate Wetness
2353	Rillito Creek above Dodge Blvd.	32.27114	-110.91171	7/30/2010	863	Yes	Normal (-13)	Moderate Wetness
9485700	Rillito Creek at Dodge Blvd. at Tucson, AZ	32.27139	-110.91389	7/31/2010	7,660	Yes	Normal (-12)	Mild Wetness
9486055	Rillito Creek at La Cholla Blvd. near Tucson, AZ	32.30333	-111.01139	7/30/2010	1,998	Yes	Drier-than-Normal (-7)	Moderate Wetness
2363	Rillito Creek at La Cholla Blvd	32.30269	-111.01144	7/31/2020	15,456	Yes	Drier-than-Normal (-7)	Moderate Wetness



## ATTACHMENT B: RFCD ANALYSIS OF GAGE DATA



**Flow Connectivity: Barrel Canyon to the Santa Cruz River**  
**RS 01/19/2021**

**Project Goal:**

In April of 2020, changes to the definition of Water of the US (WOTUS) were made by the EPA and US Army Corps of Engineers. WOTUS distinction is now applied to waterways connected to traditionally navigable waters under the criterion that they be relatively permanent. This may mean that waterways with flow capable of eventually reaching a navigable waterway are eligible for protection status.

The purpose of this project is to explore the flow connectivity and jurisdictional status of tributary beginning at USGS 09484580 – *Barrel Canyon near Sonoita, AZ* to the traditionally navigable waterway of the Santa Cruz River via Barrel Canyon, Davidson Canyon, Cienega Creek, Pantano Wash, and Rillito Creek. Identifying runoff events that begin at Barrel Canyon and eventually reach the Santa Cruz River could potentially deem the tributary as a WOTUS.

**Methods:**

Connectivity between reaches of the tributary was determined using USGS and Pima County RFCD stream gauges along the Barrel Canyon to Santa Cruz watercourse. Runoff events measured at one gauge were determined to correspond with events measured at downstream gauges based on presence of downstream data, elapsed time between gauge measurements, and regional precipitation depth measurements. The data period used for this study was limited to January 19, 2009 to November 20, 2020, which is the period of the available data for the most upstream gauge USGS 09484580 *Barrel Canyon near Sonoita, AZ*.

Locations of Stream Gauges between Barrel Canyon and the Santa Cruz River Included in Study

Ownership	Gauge #	Gauge Name	Latitude	Longitude
USGS	9484580	Barrel Canyon near Sonoita, AZ	31.86167	-110.69056
RFCD	4313	Davidson Canyon Wash above I-10	31.99358	-110.64513
RFCD	4253	Pantano Wash near Vail (Pantano Dam)	32.03611	-110.67667
RFCD	4263	Pantano Wash at Schist	32.04327	-110.69001
USGS	9485450	Pantano Wash at Broadway Blvd. at Tucson, AZ	32.22056	-110.82889
RFCD	2353	Rillito Creek above Dodge Blvd.	32.27114	-110.91171
RFCD	2363	Rillito Creek at La Cholla Blvd	32.30269	-111.01144
RFCD	6013	Santa Cruz River below Canada del Oro Wash	32.32816	-111.06856

Reach travel times vary significantly with depth of flow, antecedent moisture conditions, and channel morphology. To account for this variability, travel time between gauges was estimated to be within a timespan of several hours, with gauges farther apart having more travel time variability than gauges closer together.

While this study attempts to identify flows starting at site 09484580 that outlet into the Santa Cruz River, many flows in Rillito Creek are not of high enough stage to be registered at the nearest downstream gauge in the Santa Cruz River. In this particular study, only three flows were registered in the Santa Cruz River for the identified events within the gauge's data history. Only flows with sufficient stage that may have been able to reach the Santa Cruz River from La Cholla Boulevard were determined to be potentially connective.

Additionally, being that the gauges are intended to measure significant floods, the relatively high elevation of some of the sensors above the invert affects the accuracy of the flow time-measurement. No data is recorded on the amount or duration of flow when the stage is too low to meet the sensor, both before and after the flood peak. Flow events occurring very near or slightly after downstream measurements were made were not excluded from the study for this reason.



### **Potentially Connective Events:**

Eleven potentially connective runoff events were identified for this watercourse and are described below. This is followed by an appendix that includes for each event a stage versus time graph, a flow event comparison graph, a Qualitative Precipitation Estimate (QPE) or other rainfall totals graphic, and an event summary table.

9/24/2019 –

Widespread rainfall occurred with an average depth of 2" occurred over the Vail area, northeastern Santa Rita Mountains area, Las Cienegas NCA, and southwestern Rincon foothills. Additional rain of average depth 1.25" fell over the eastern Santa Catalina Mountains and Redington Pass.

Flow at Pantano Dam and Pantano at Schist reached peak depths of 5' which was likely able to reach at least Rillito Creek at La Cholla. Hydrograph shapes have two peaks up until Pantano at Schist, then flatten more at downstream gauges. Flows already existing at Rillito at La Cholla make it difficult to tell if the flow was truly continuous, but the significant amount of overlap suggests this as a possibility.

8/10/2019 –

Rainfall was recorded in the northeastern Santa Ritas and Vail area with a depth of 1-2", in the Tanque Verde area with depth 1.75-2.25", and in the upper Sabino Canyon watershed with a maximum depth of 3.0".

Hydrographs for this time period are bisected between what appears to be two separate runoff events. Flows seem to align between Barrel Canyon and Pantano at Schist, but at starting at Pantano at Broadway the hydrographs no longer seem to correlate. This runoff event was chosen under the possibility that the first of the two hydrographs up until Pantano at Schist may have corresponded to the second of the hydrographs at the gauges between Pantano at Broadway and Rillito at La Cholla. Reasonable overlap times assist this claim, but more analysis is needed to determine whether the upper watershed runoff was truly able to contribute to the downstream runoff in a connective way.

9/19/2018 –

Rainfall occurred over the Vail area, northeastern Santa Ritas, and Cienega Creek area with a depth of 1.25-2". Rain through the rest of Rillito watershed was minimal except for some rainfall along Tanque Verde Ridge (1-1.5").

The isolated nature of this storm event produced large and condensed hydrographs that are very apparently connected throughout the drainage. Although the flood peak at Barrel Canyon was recorded two hours after the peak at Davidson Canyon, the rainfall amounts in the general area suggest the possibility that flow occurred but the water surface elevation was not high enough to be recorded.

7/23/2017 –

Rainfall occurred at the northern end of the Las Cienegas NCA with a max depth of about 2.75", as well as in Redington Pass with a max depth of 2.0". Some rainfall occurred in the Barrel Canyon watershed with depths of 0.25-0.75". Some rainfall in the upper Sabino Canyon watershed likely contributed to flows in Rillito Creek.

Only a 6" change in stage was measured in Barrel Canyon, but the high position of the gauge (3.5') means flows may have been significant to contribute to Davidson Canyon. From Davidson Canyon, it is clear that the flow reached to at least Rillito at La Cholla based on the near copies of the hydrographs produced downstream. Although the large storm at Las Cienegas NCA produced a majority of the flow, runoff at Davidson canyon is identifiable throughout.



7/20/2017 –

Rainfall occurred along Cienega Creek both N and S of I-10, as well as at Vail, Rincon Creek, and the Catalina Foothills, mostly ranging between 0.75" and 3.0". Less than 1" was recorded in the Barrel Canyon watershed, but flows were recorded at 3.6' depth.

Shallow hydrographs occurred at Barrel Canyon and Davidson canyon, indicating relatively low flows. It is possible that flow from Davidson Canyon reached Cienega Creek, but was ultimately connected to the Santa Cruz through the flow provided by Cienega Creek and Vail rainfall event.

8/2/2016 –

Isolated rainfall occurred in the northeastern Santa Rita Mountains and Davidson Canyon area, as well as rainfall near Vail and Redington Pass, both with rainfall depths between 2.0" and 3.0". The event occurring in the Santa Ritas created a flood with a depth of 6.5' at Barrel Canyon and above 5' at Davidson Canyon, Pantano Dam, and Pantano at Schist.

Hydrographs between Davidson Canyon and La Cholla are of similar duration and shape, strongly suggesting continuous flow from at least Davidson Canyon.

7/31/2016 –

Rain in the Whetstone Mountains (2.5" to 4.0"), northeastern Santa Rita Mountains (2.0"), and S of I-10 near Cienega Creek (1.5" to 2.75") contributed to seemingly connective flows with depth ranging from 2' to 4.75'.

Hydrographs are somewhat aligned in time and have significant overlap to suggest connectivity, although this may have been exaggerated by surface drainage in central and SE Tucson and flow beginning in Redington Pass.

9/3/2015 –

Broad rainfall ranging from 0.5" to 2.0" occurring in the northeastern Santa Ritas, Vail Area, and northern Cienega Creek area produced large flows in the Pantano Wash (4.5' depth).

Temporal spacing of hydrograph peaks between Davidson Canyon and Rillito at Dodge suggest a continuous flow event between the two, although change in stage at La Cholla is relatively small.

7/13/2014 –

Poor quality rainfall QPE has made flow observations less accurate for this event. Low rainfall depths were recorded throughout the Davidson Canyon watershed, but more significant rainfall (0.5-1.0") was recorded near Tanque Verde, Rincon Creek area, and NW of Vail.

It cannot be said that hydrograph peaks were not influenced by tributary flow, but a general overlap in hydrograph timelines suggests flow connectivity throughout the watershed.

7/9/2014 –

Previous 24hr rainfall depths indicate minor rainfall depths of 0.4-0.5" in the Barrel Canyon watershed, with widespread 0.5-1.0" of rain recorded over Vail, the northern portion of Cienega Creek, Davidson Canyon, and Rincon Creek. Flow events follow a timeline indicating little influence from other runoff sources.

7/30/2010 –

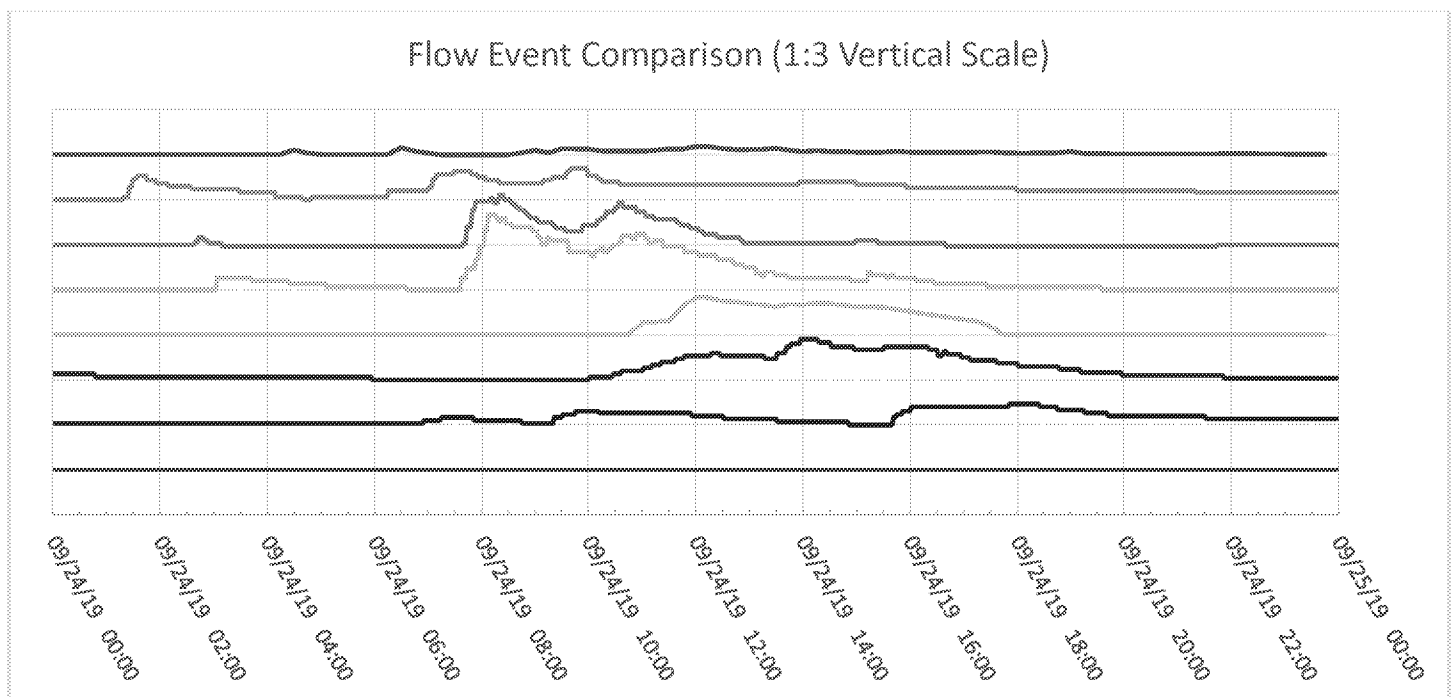
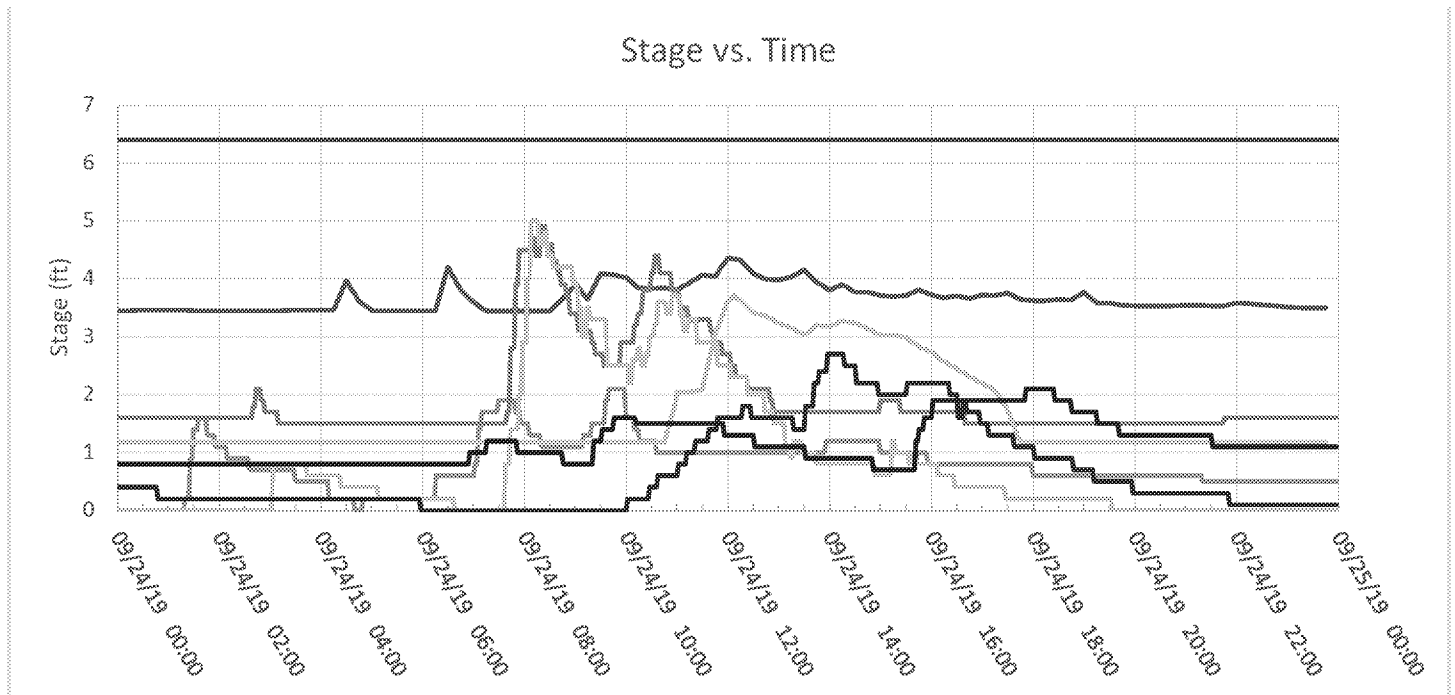


Previous 24hr rainfall depths in the Barrel Canyon watershed ranged between 0.4" and 0.75", while multiple areas of rainfall over 1.25" were recorded near Vail, around Davis Monthan Air Force Base, and in the Tanque Verde Area.

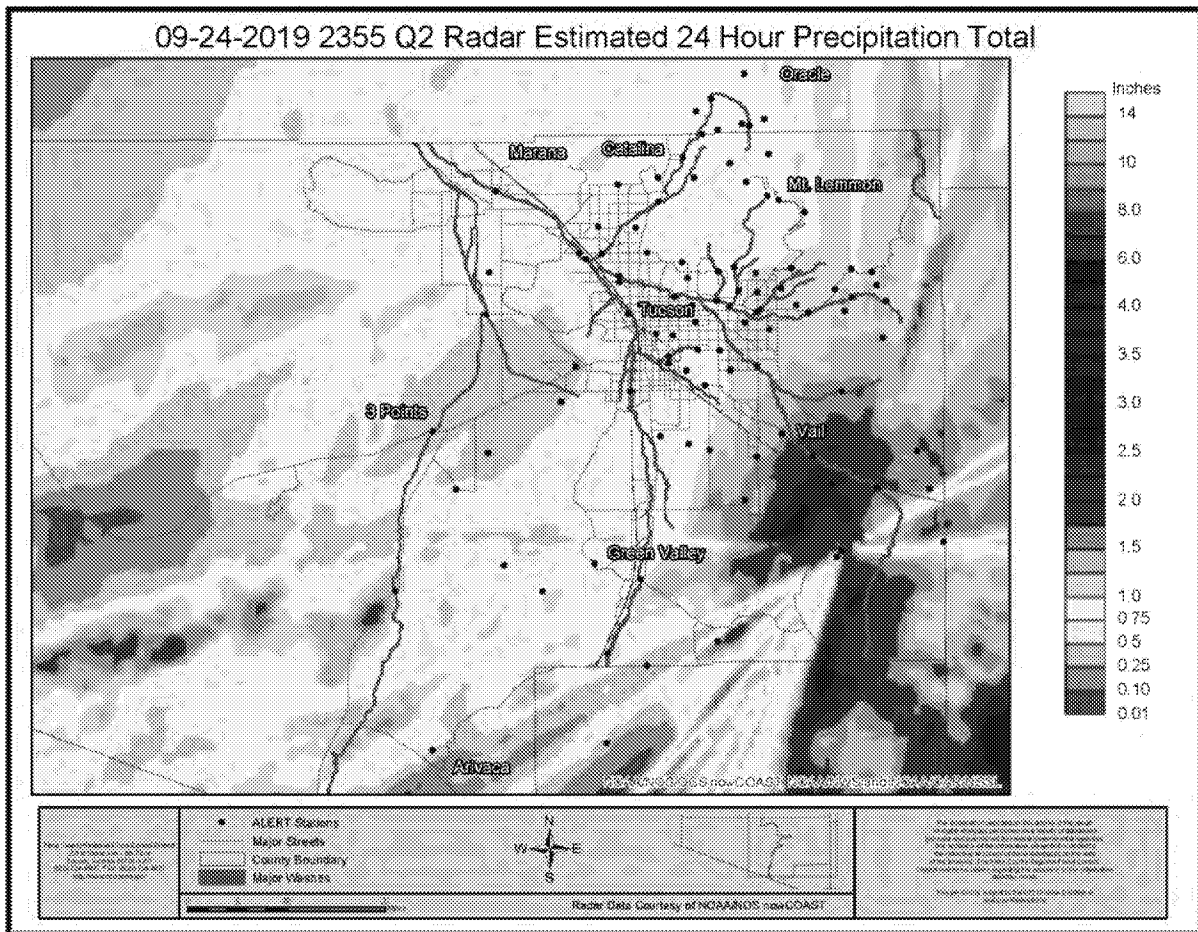
Flow depth of 3.6' was recorded at Barrel Canyon at 19:30 on 7/30, but quickly receded below the gauge's measurable level (3.2') 30 minutes later. Similar or greater peak flow depths were recorded at the downstream gauges. Event connectivity is likely with flow initially starting at Barrel Canyon being met with larger flows from upper Cienega Creek, Agua Caliente Wash, and Tanque Verde Creek.



24 September 2019





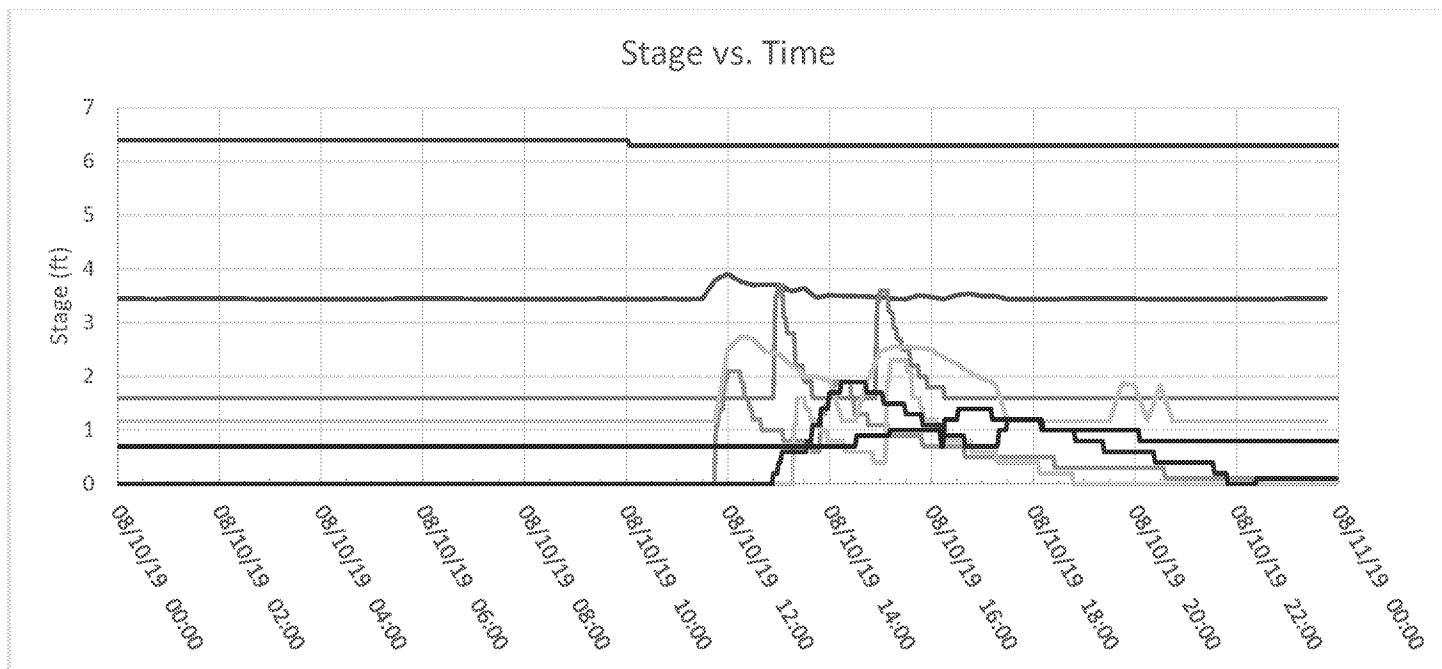


24-hour Qualitative Precipitation Estimate: Recorded at 11:55 PM 9/24/2019

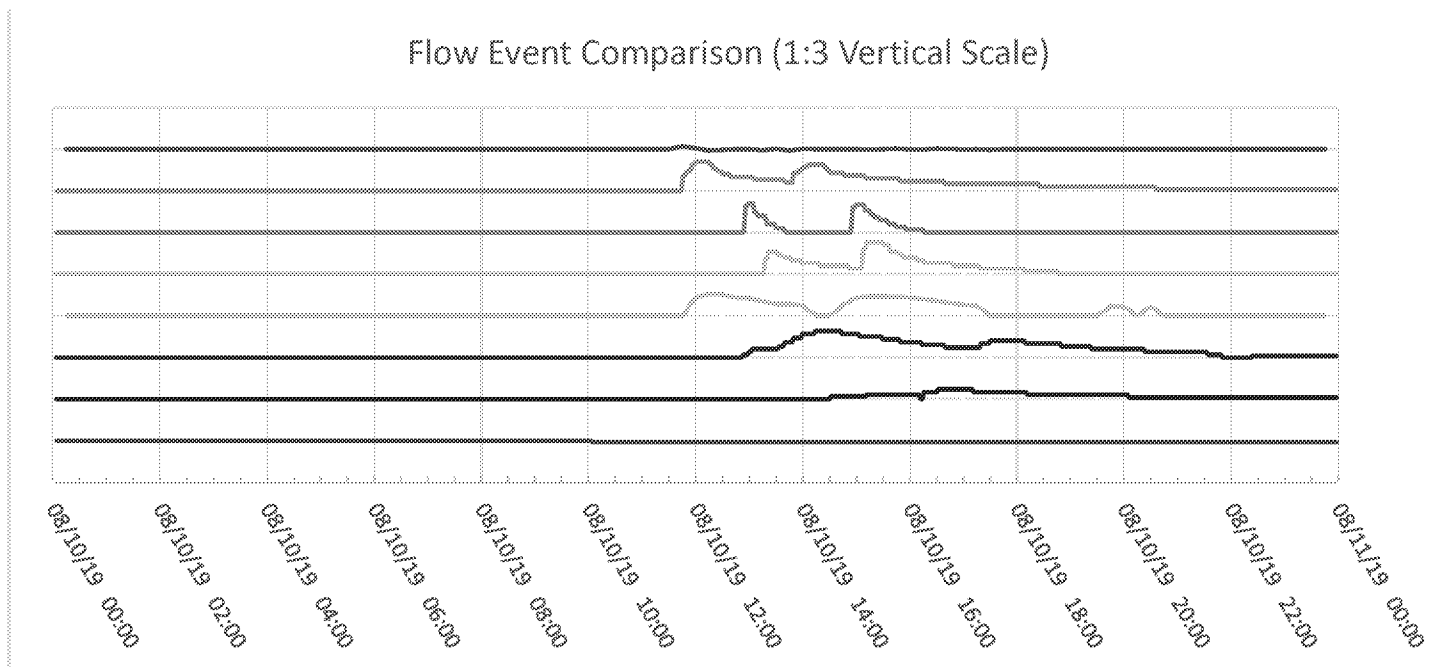
Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita, AZ	9/24/2019	153			Mid-Range
Pima County 4313 - Davidson Canyon near I-10	9/24/2019	1315			Mid-Range
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	9/24/2019	3247			Mid-Range
Pima County 4263 - Pantano Wash at Schist	9/24/2019	2182			Mid-Range
USGS 09485450 - Pantano Wash at Broadway Blvd	9/24/2019	1470			Mid-Range
Pima County 2353 - Rillito Creek above Dodge Blvd	9/24/2019	1357			Mid-Range
Pima County 2363 - Rillito Creek at La Cholla Blvd	9/24/2019	316			Mid-Range
Pima County 6013 - Santa Cruz below CDO Wash	N/A	1			Mid-Range



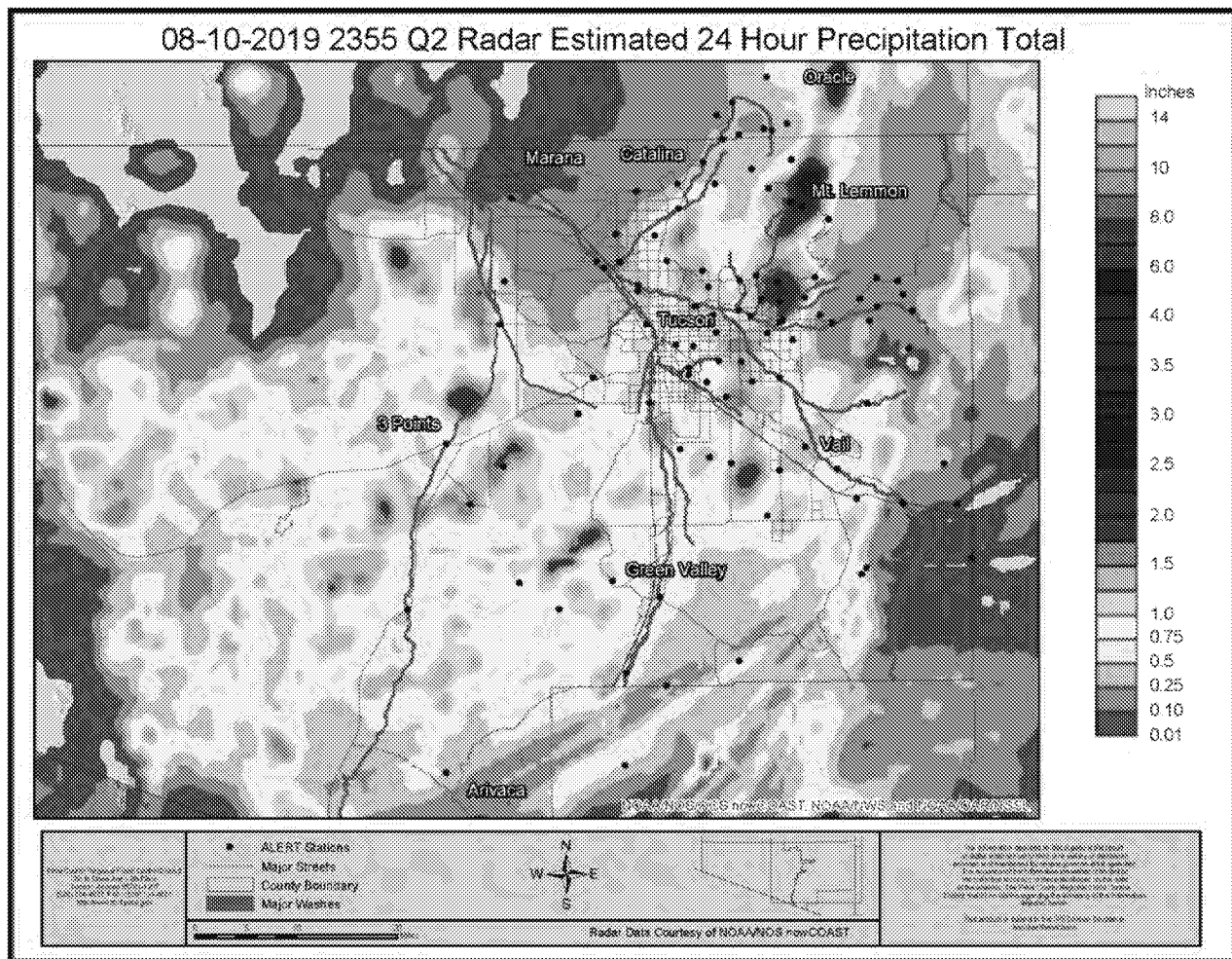
10 August 2019



Barrel Canyon Davidson Canyon Pantano Dam Pantano at Schist  
Pantano at Broadway Rillito at Dodge Rillito at La Cholla Santa Cruz at CDO



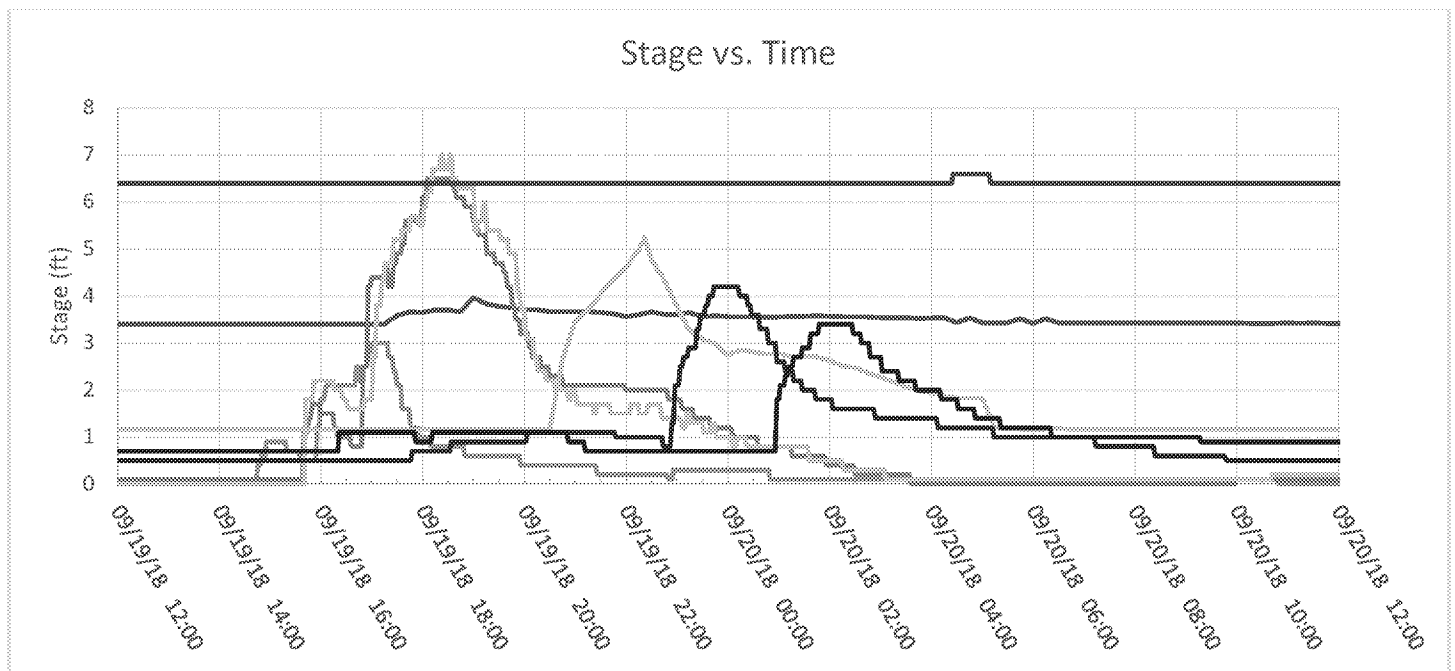




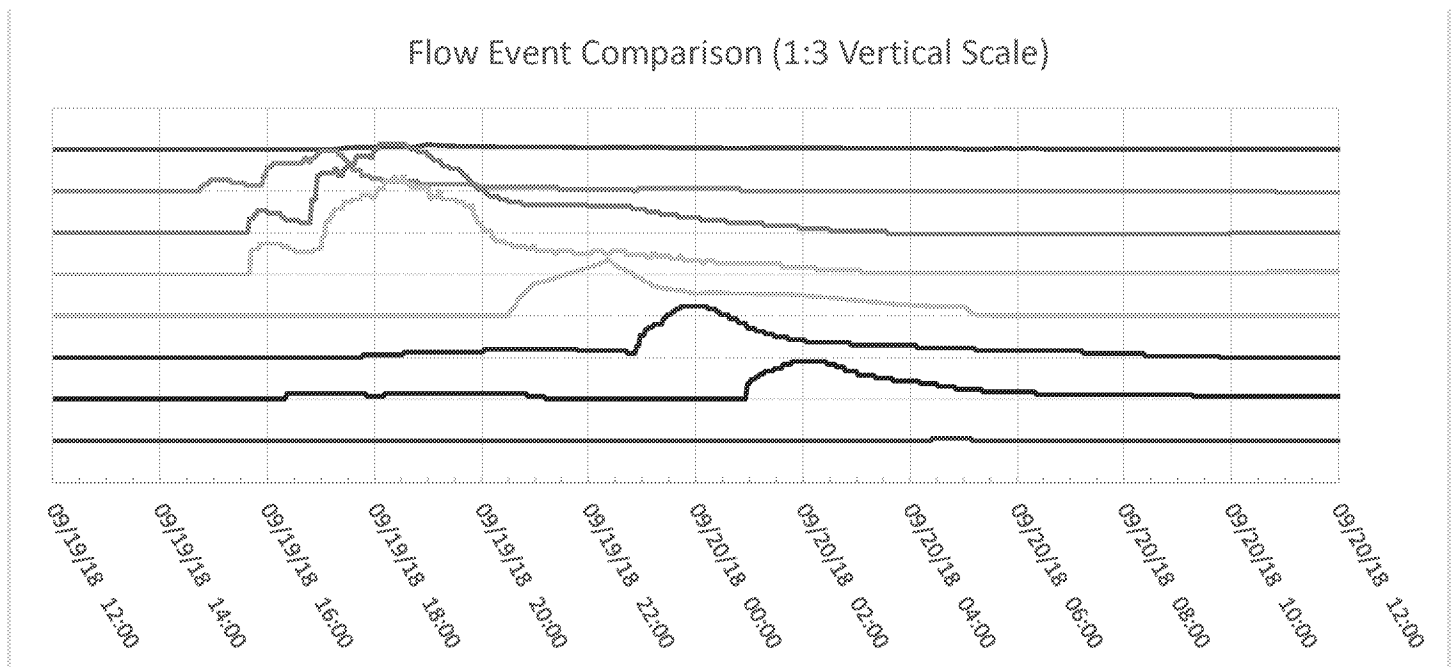
24-hour Qualitative Precipitation Estimate: Recorded at 11:55 PM 8/10/2019

Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita	8/10/2019	33.6			Mid-Range
Pima County 4313 - Davidson Canyon near I-10	8/10/2019	1315			Mid-Range
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	8/10/2019	1804			Mid-Range
Pima County 4263 - Pantano Wash at Schist	8/10/2019	446			Mid-Range
USGS 09485450 - Pantano Wash at Broadway	8/10/2019	366			Mid-Range
Pima County 2353 - Rillito Creek above Dodge Blvd	8/10/2019	729			Mid-Range
Pima County 2363 - Rillito Creek at La Cholla Blvd	8/10/2019	116			Mid-Range
Pima County 6013 - Santa Cruz below CDO Wash	N/A	1			Mid-Range

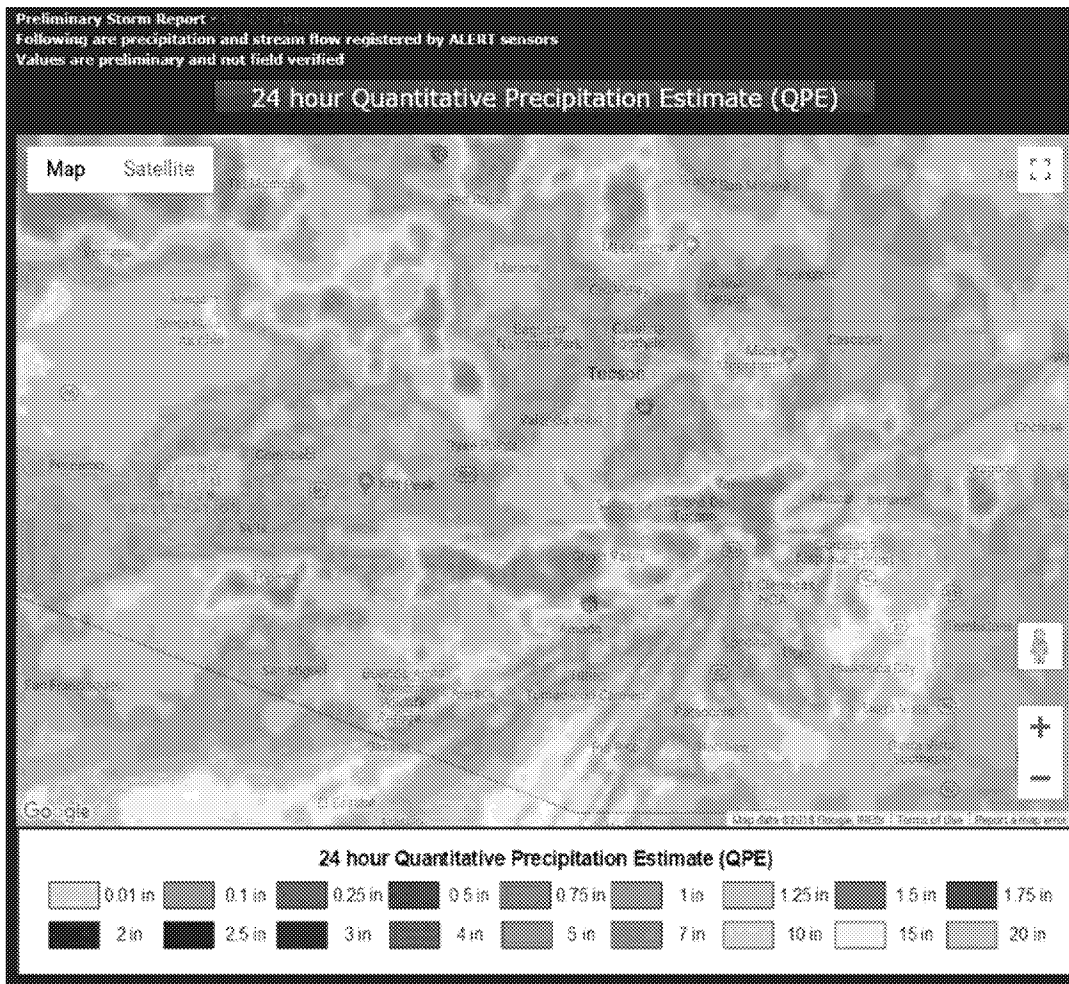




— Barrel Canyon      — Davidson Canyon      — Pantano Dam      — Pantano at Schist  
 — Pantano at Broadway      — Rillito at Dodge      — Rillito at La Cholla      — Santa Cruz at CDO



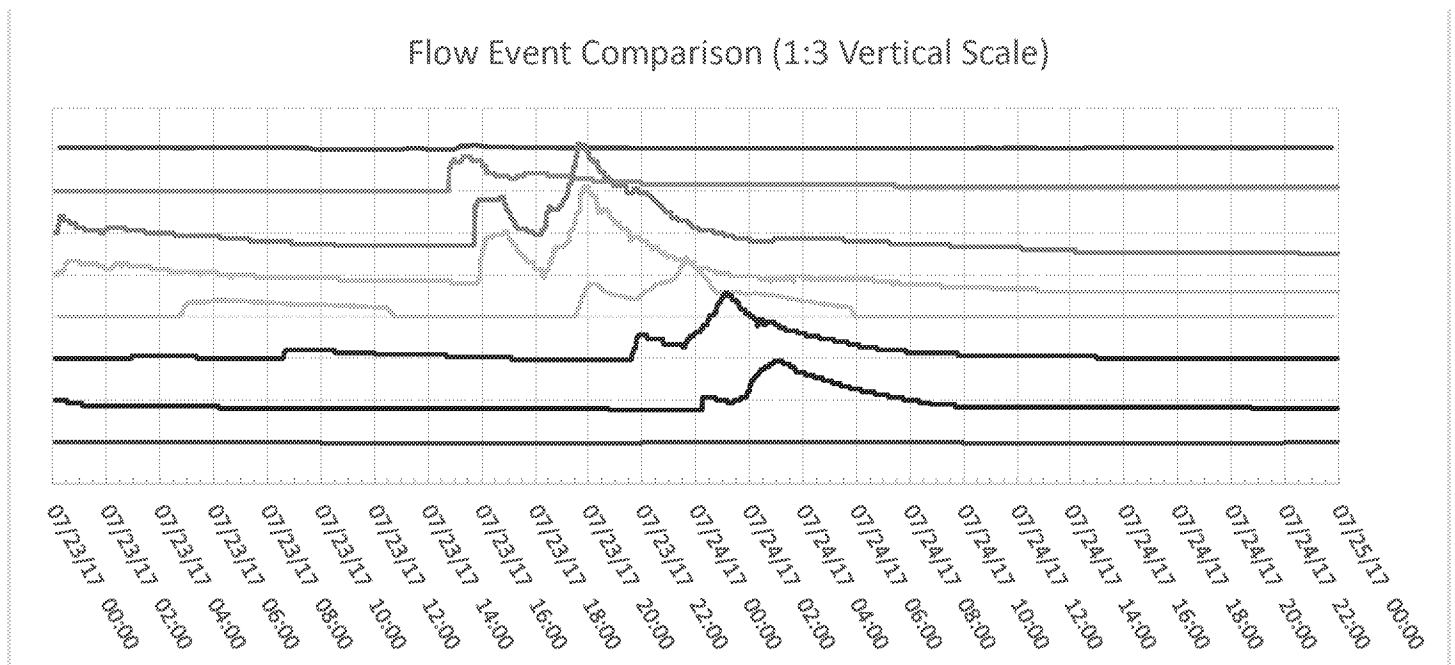
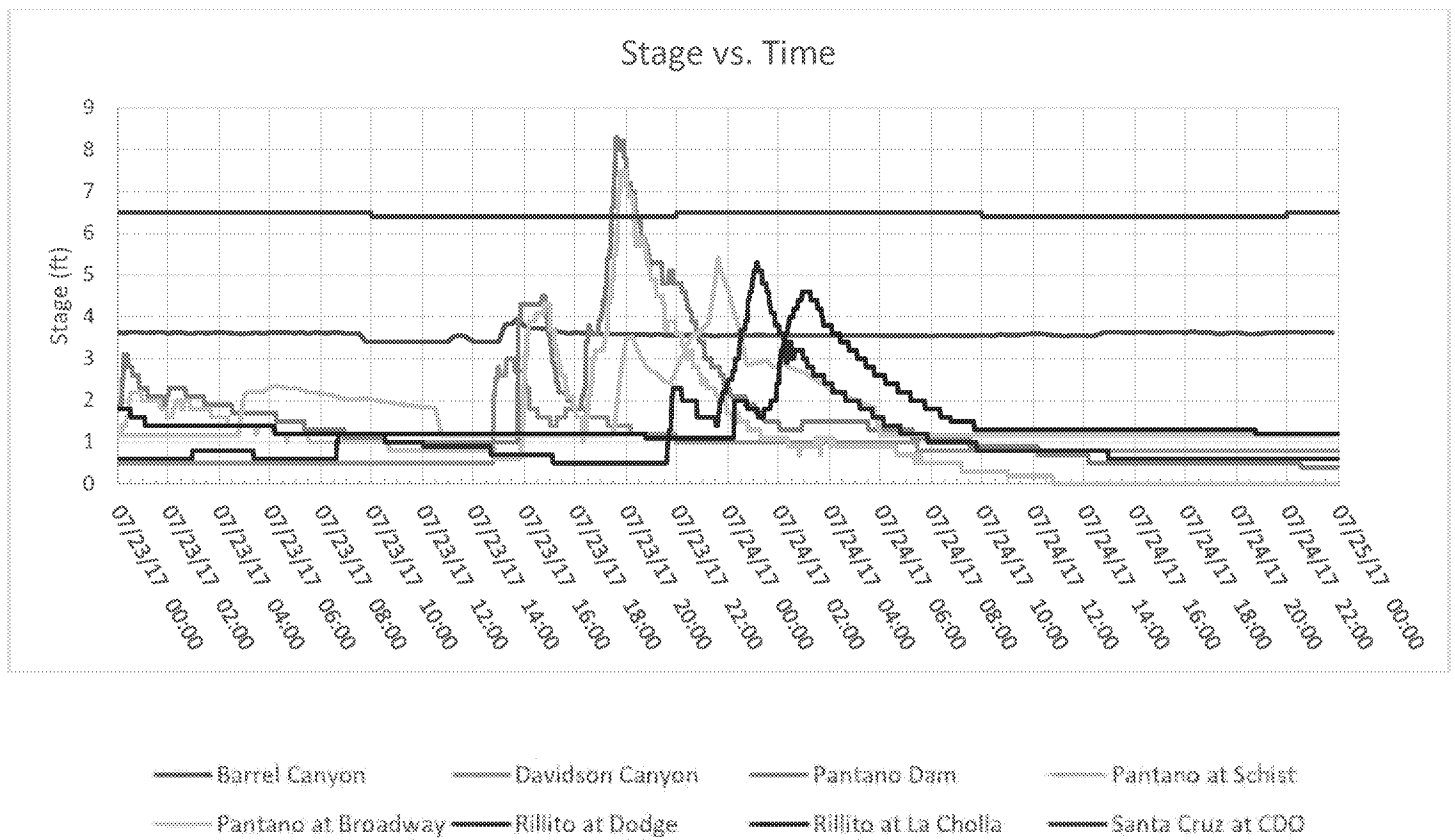




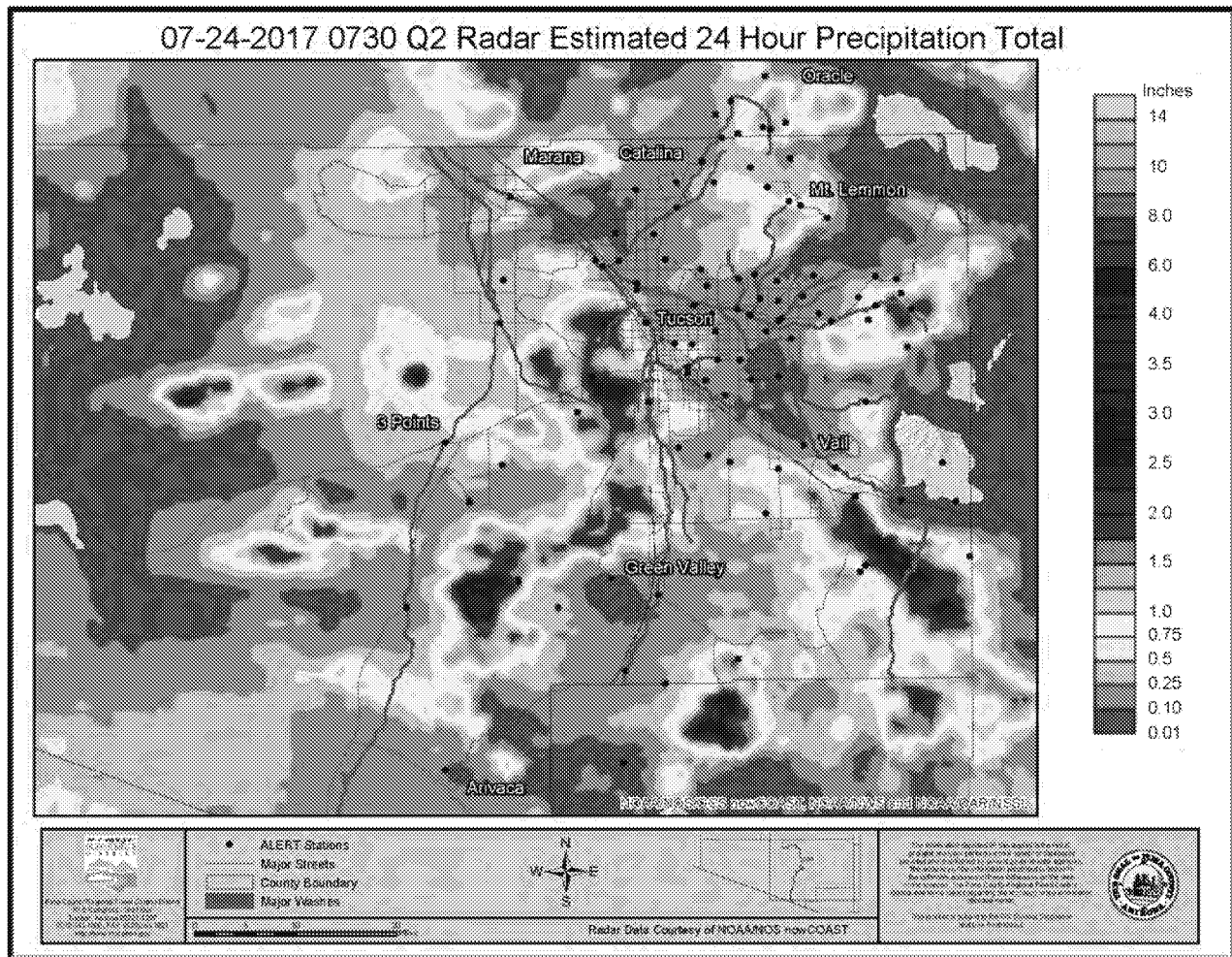
24-hour Qualitative Precipitation Estimate: Recorded at 12:00 AM PM 9/20/2019

Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita	9/19/2018	0			Severe Drought
Pima County 4313 - Davidson Canyon near I-10	9/19/2018	2260			Severe Drought
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	9/19/2018	5622			Severe Drought
Pima County 4263 - Pantano Wash at Schist	9/19/2018	4254			Severe Drought
USGS 09485450 - Pantano Wash at Broadway	9/19/2018	0			Severe Drought
Pima County 2353 - Rillito Creek above Dodge Blvd	9/20/2018	2858			Severe Drought
Pima County 2363 - Rillito Creek at La Cholla Blvd	9/20/2018	1584			Severe Drought
Pima County 6013 - Santa Cruz below CDO Wash	9/20/2018	1			Severe Drought





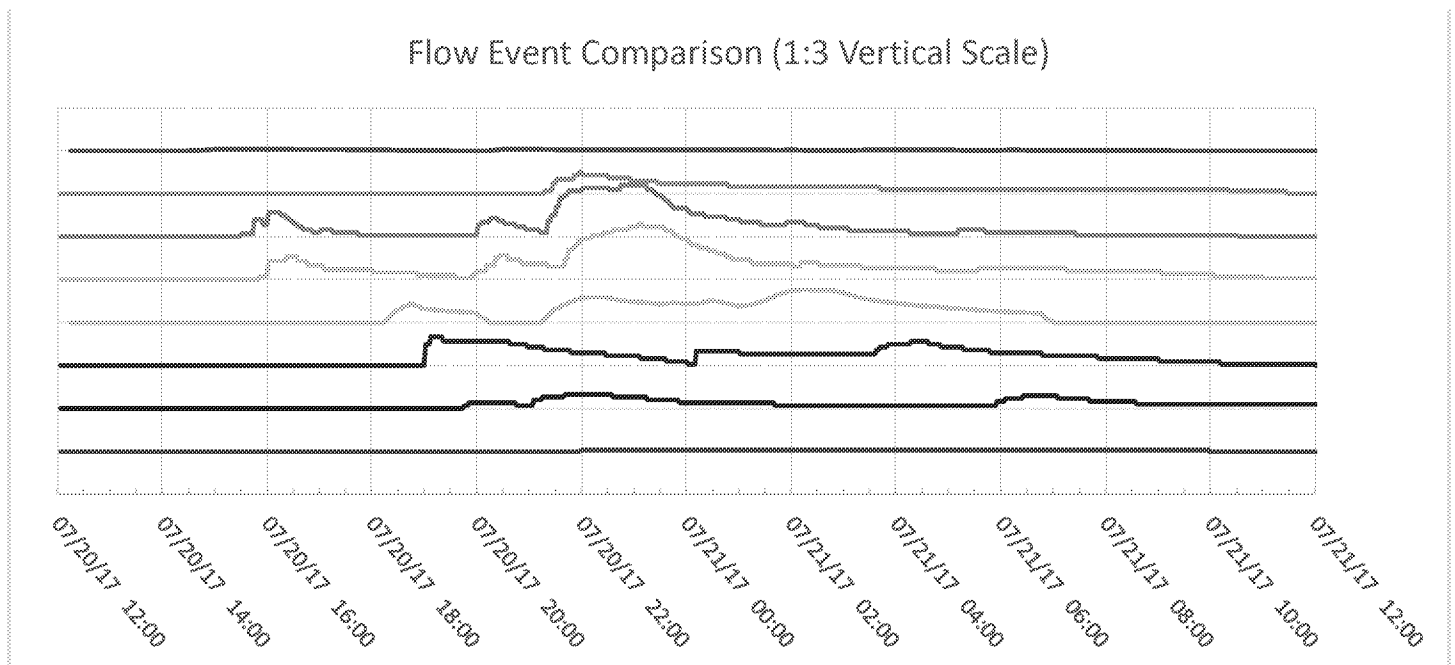
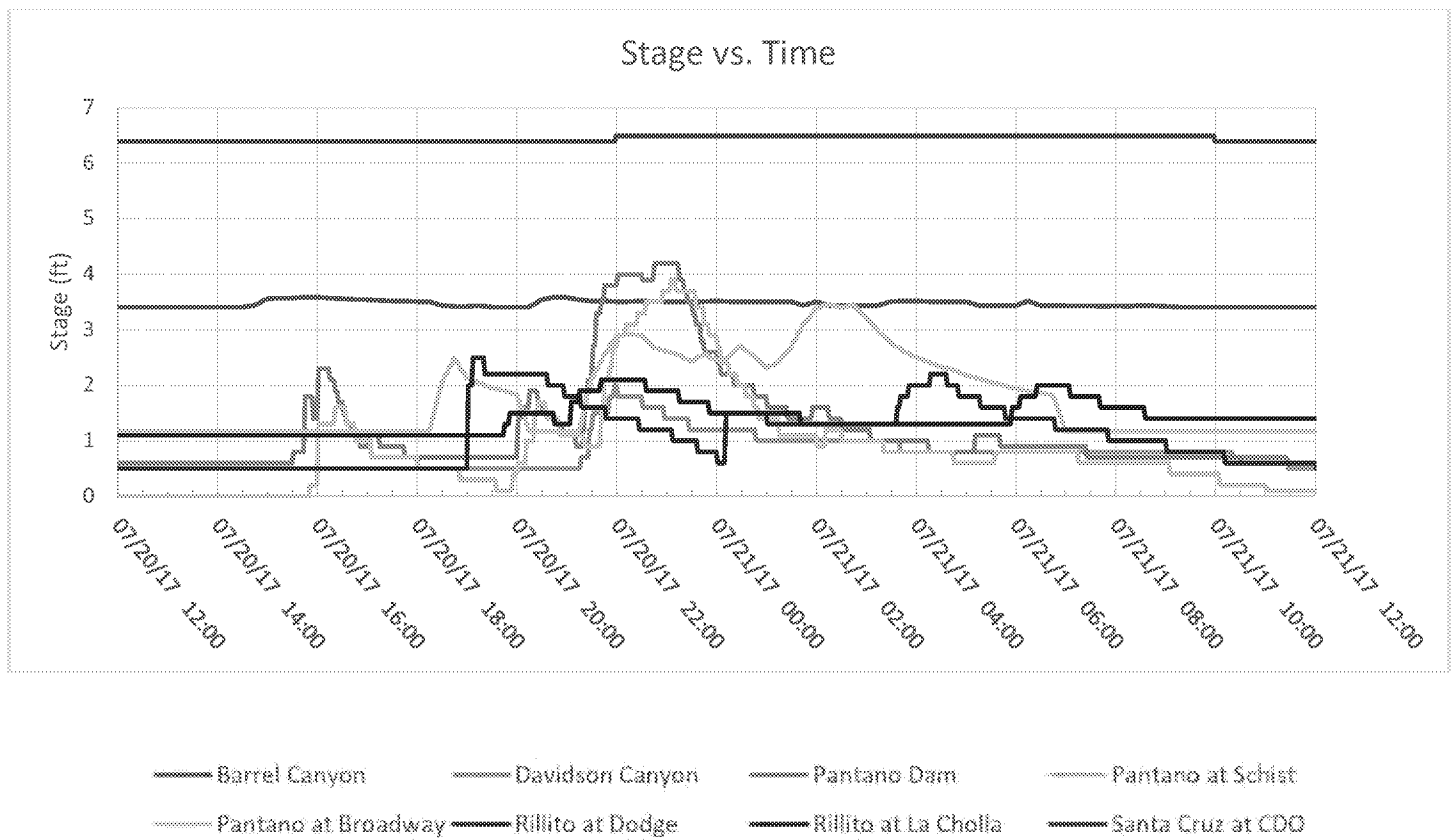




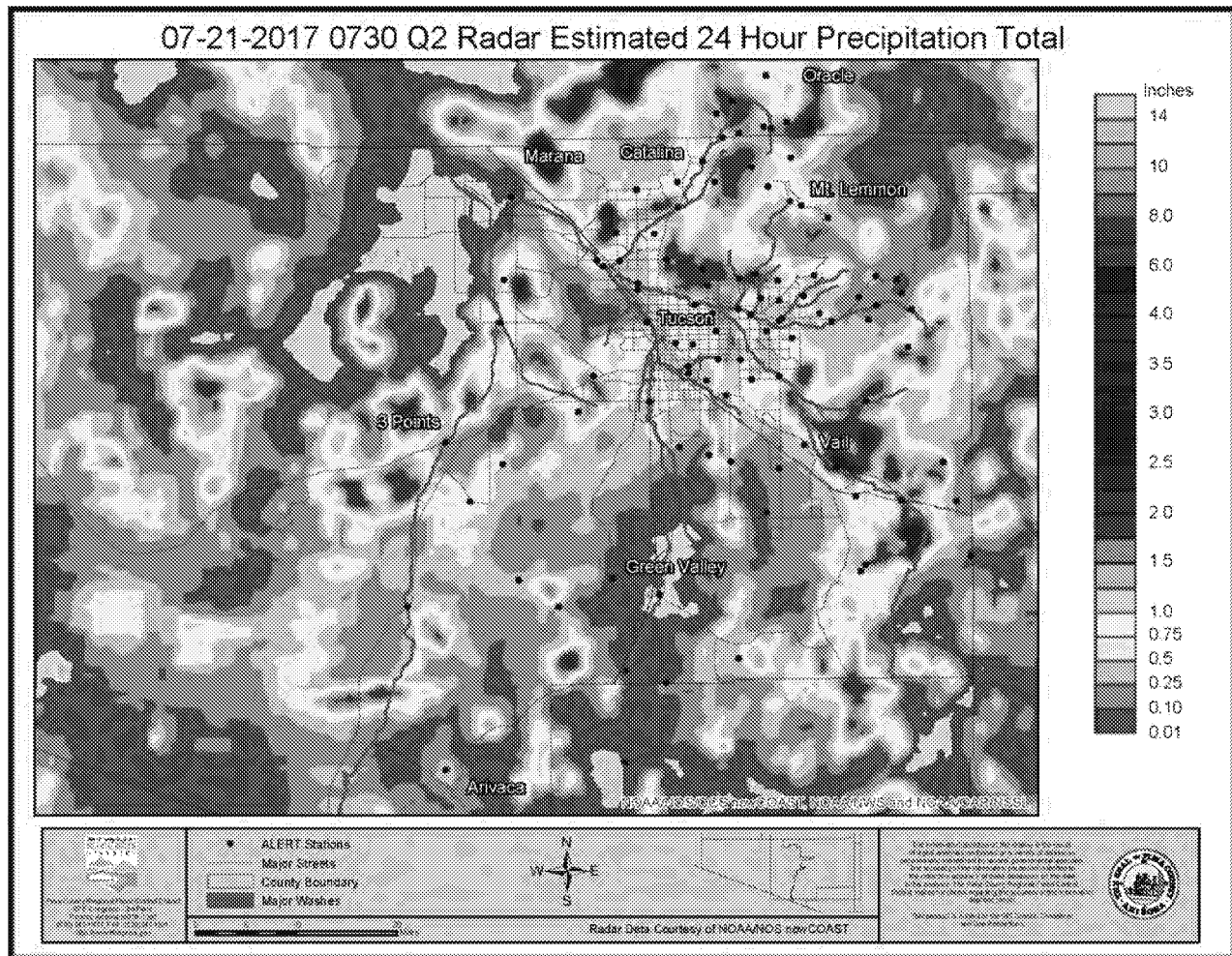
24-hour Qualitative Precipitation Estimate: Recorded at 7:30 AM 7/24/2014

Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita	7/23/2017	46.6			Mid-Range
Pima County 4313 - Davidson Canyon near I-10	7/23/2017	2260			Mid-Range
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	7/23/2017	8900			Mid-Range
Pima County 4263 - Pantano Wash at Schist	7/23/2017	4832			Mid-Range
USGS 09485450 - Pantano Wash at Broadway	7/23/2017	4020			Mid-Range
Pima County 2353 - Rillito Creek above Dodge Blvd	7/24/2017	4687			Mid-Range
Pima County 2363 - Rillito Creek at La Cholla Blvd	7/24/2017	4044			Mid-Range
Pima County 6013 - Santa Cruz below CDO Wash	7/23/2017	1			Mid-Range





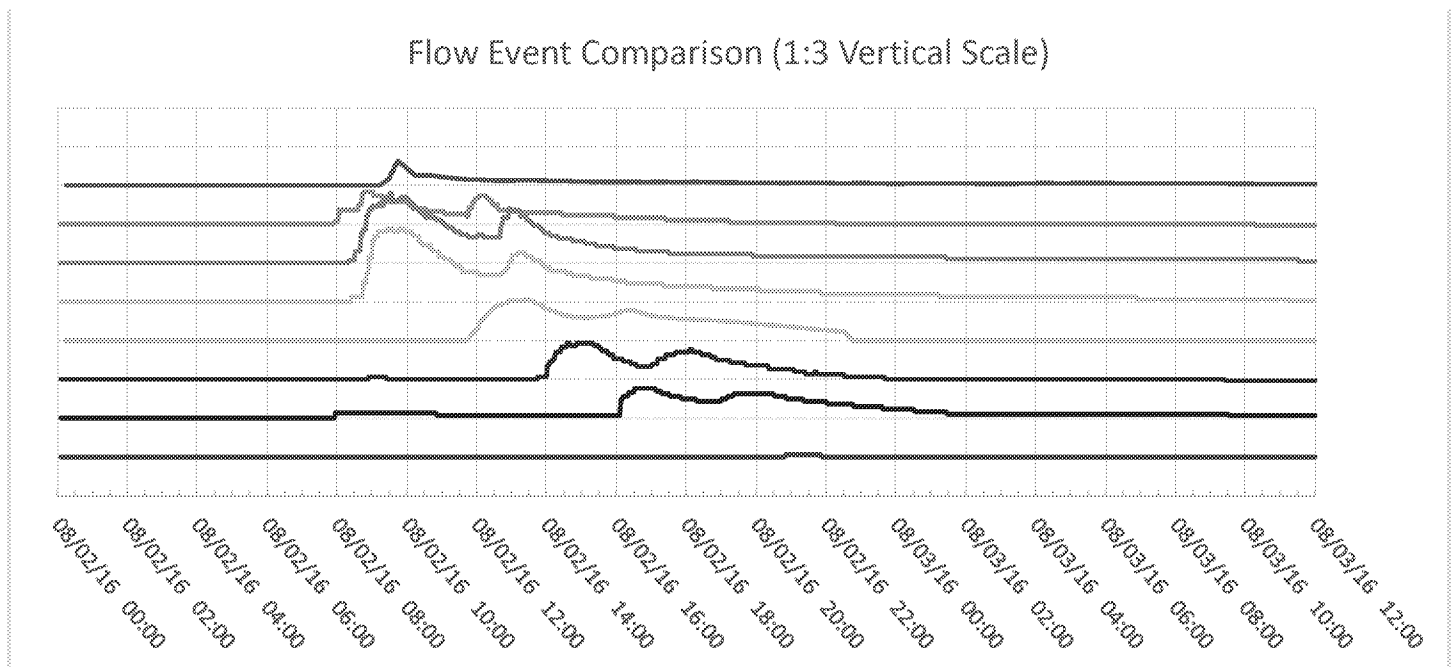
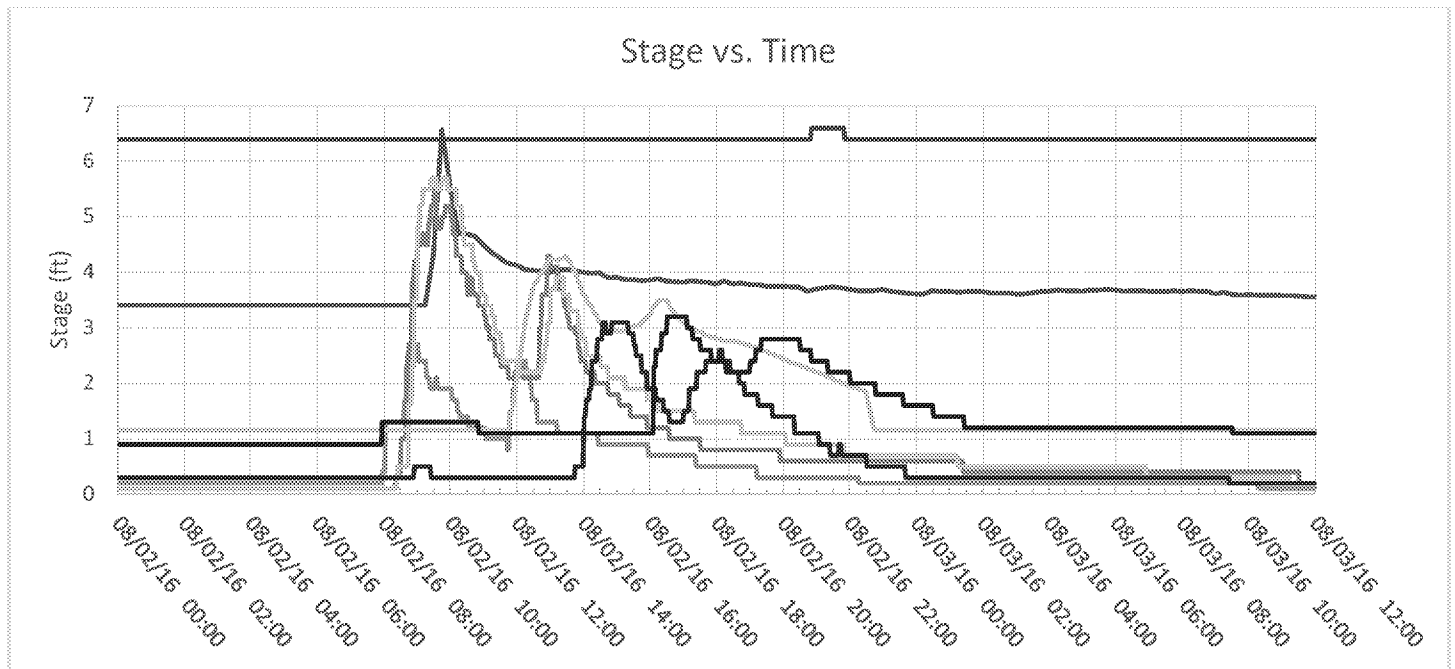




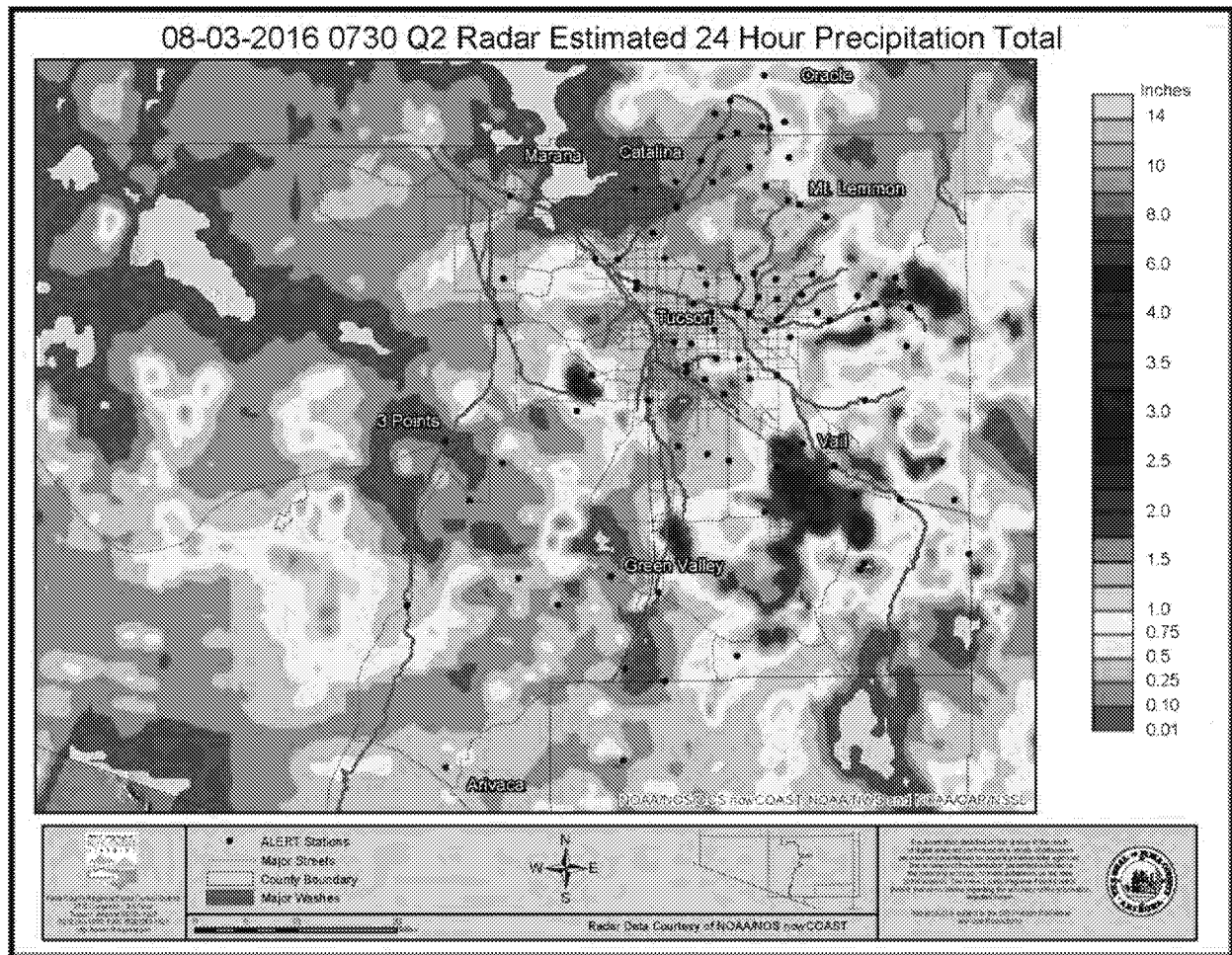
24-hour Qualitative Precipitation Estimate: Recorded at 7:30 AM 7/21/2017

Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita	7/23/2017	46.6			Mid-Range
Pima County 4313 - Davidson Canyon near I-10	7/23/2017	2260			Mid-Range
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	7/23/2017	8900			Mid-Range
Pima County 4263 - Pantano Wash at Schist	7/23/2017	4832			Mid-Range
USGS 09485450 - Pantano Wash at Broadway	7/23/2017	4020			Mid-Range
Pima County 2353 - Rillito Creek above Dodge Blvd	7/24/2017	4687			Mid-Range
Pima County 2363 - Rillito Creek at La Cholla Blvd	7/24/2017	4044			Mid-Range
Pima County 6013 - Santa Cruz below CDO Wash	7/23/2017	1			Mid-Range





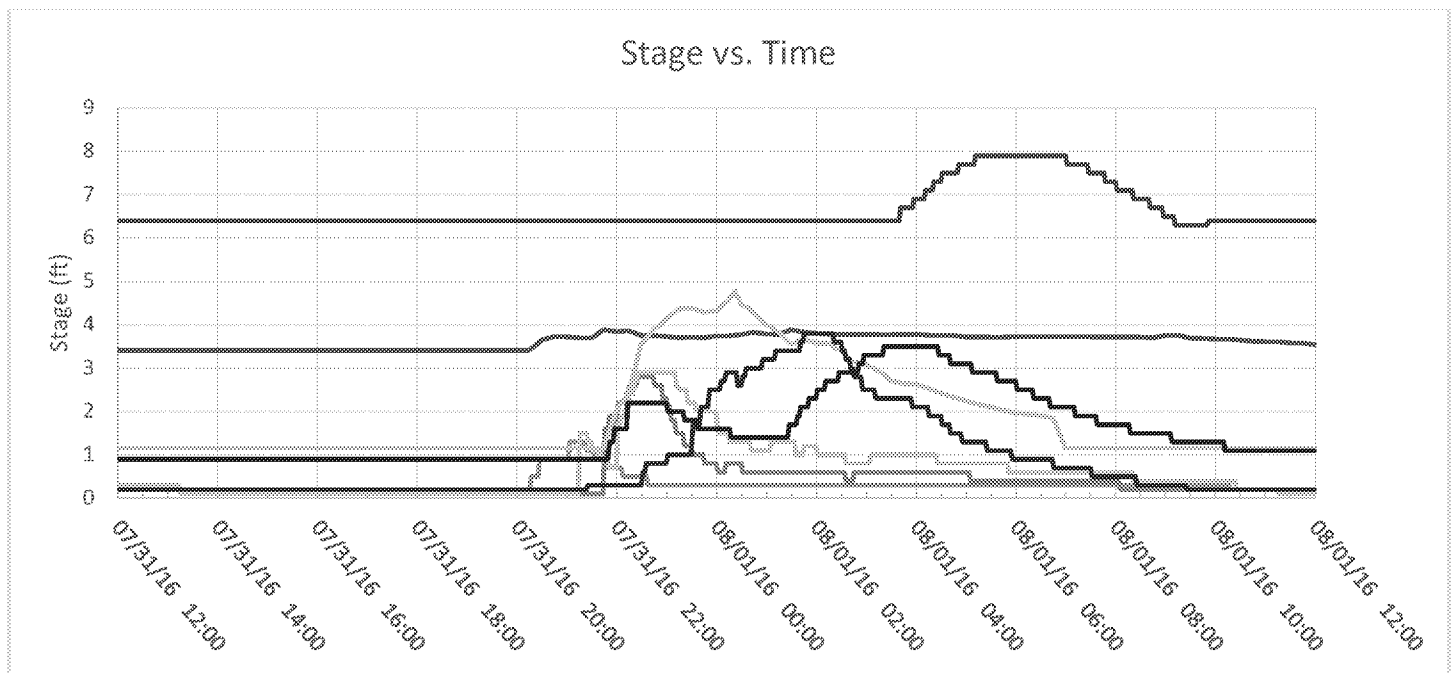




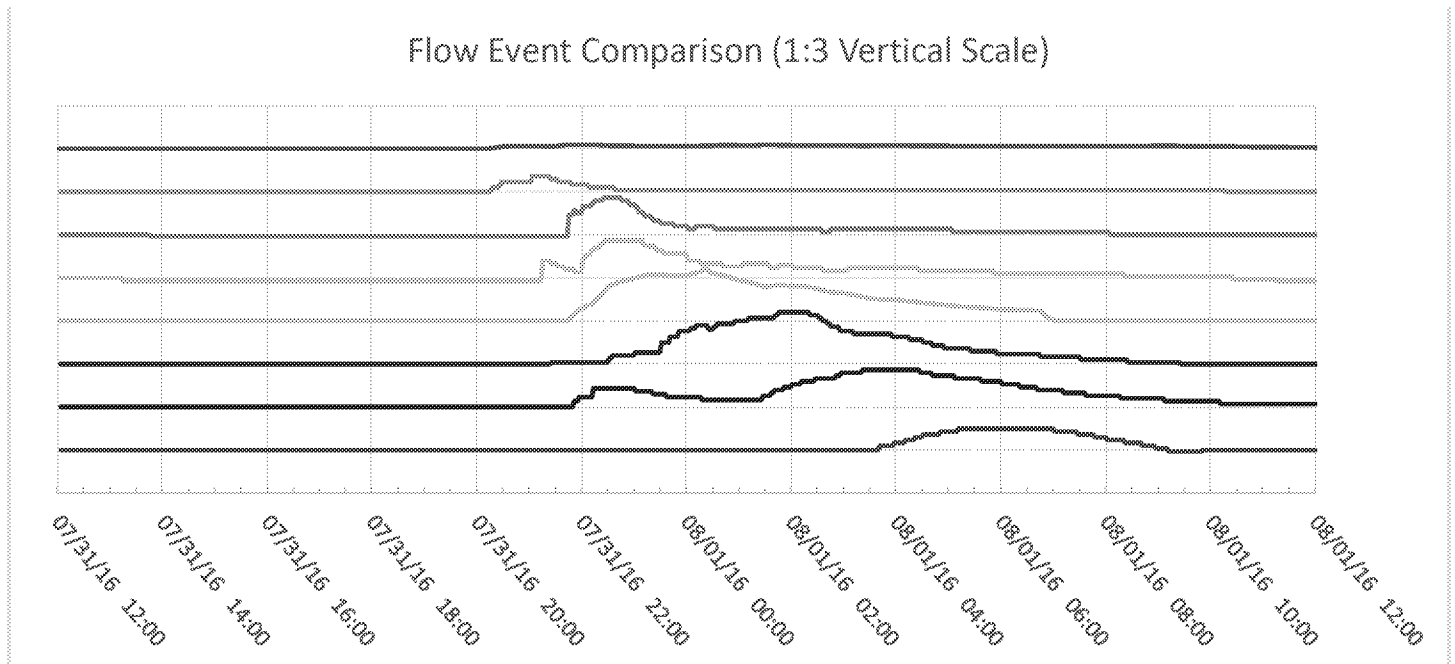
24-hour Qualitative Precipitation Estimate: Recorded at 7:30 AM 8/3/2016

Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita	8/2/2016	1200			Moderate Drought
Pima County 4313 - Davidson Canyon near I-10	8/2/2016	1945			Moderate Drought
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	8/2/2016	4081			Moderate Drought
Pima County 4263 - Pantano Wash at Schist	8/2/2016	2846			Moderate Drought
USGS 09485450 - Pantano Wash at Broadway	8/2/2016	2220			Moderate Drought
Pima County 2353 - Rillito Creek above Dodge Blvd	8/2/2016	1742			Moderate Drought
Pima County 2363 - Rillito Creek at La Cholla Blvd	8/2/2016	1286			Moderate Drought
Pima County 6013 - Santa Cruz below CDO Wash	8/2/2016	1			Moderate Drought

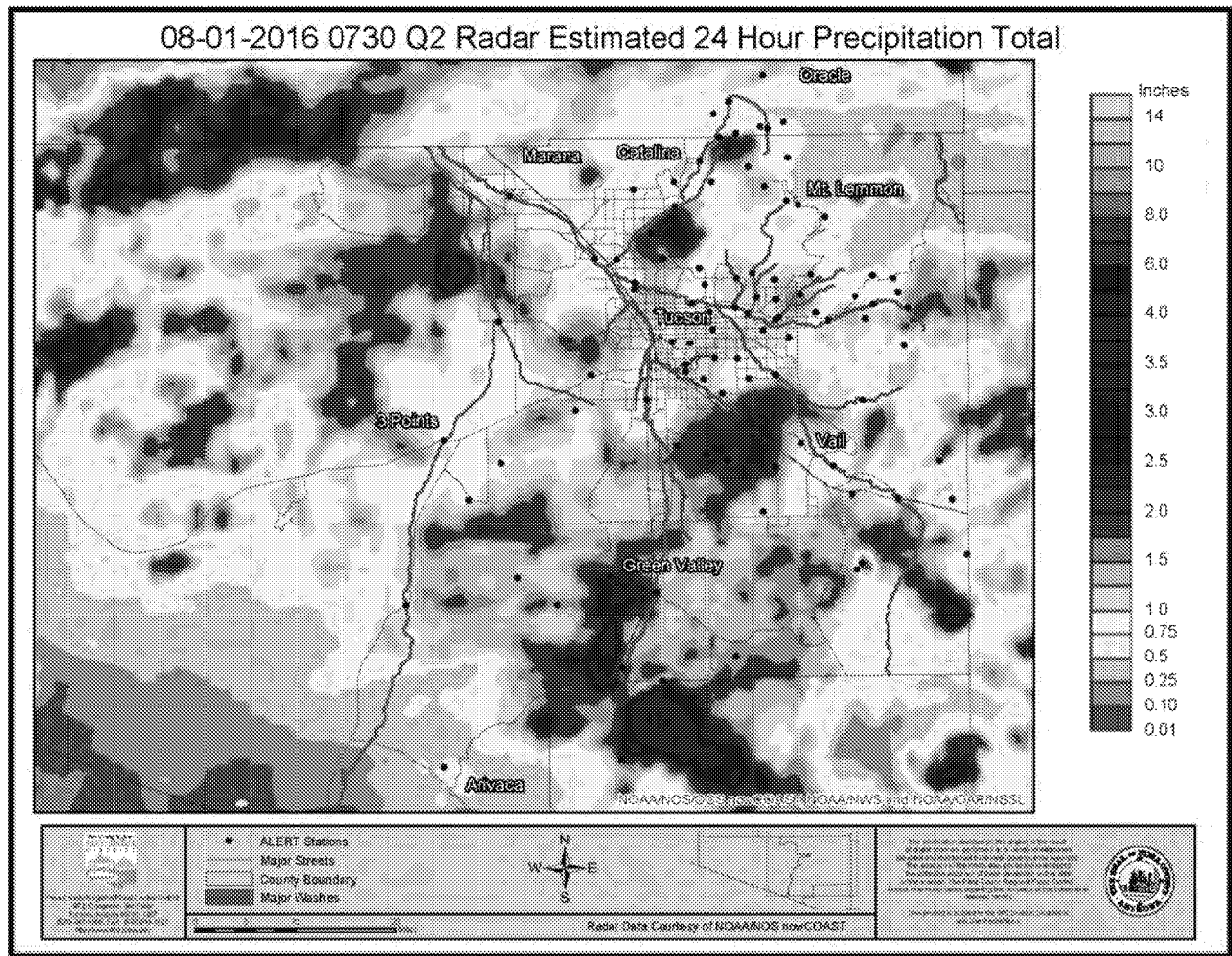




Barrel Canyon
  Davidson Canyon
  Pantano Dam
  Pantano at Schist
  Pantano at Broadway
  Rillito at Dodge
  Rillito at La Cholla
  Santa Cruz at CDO





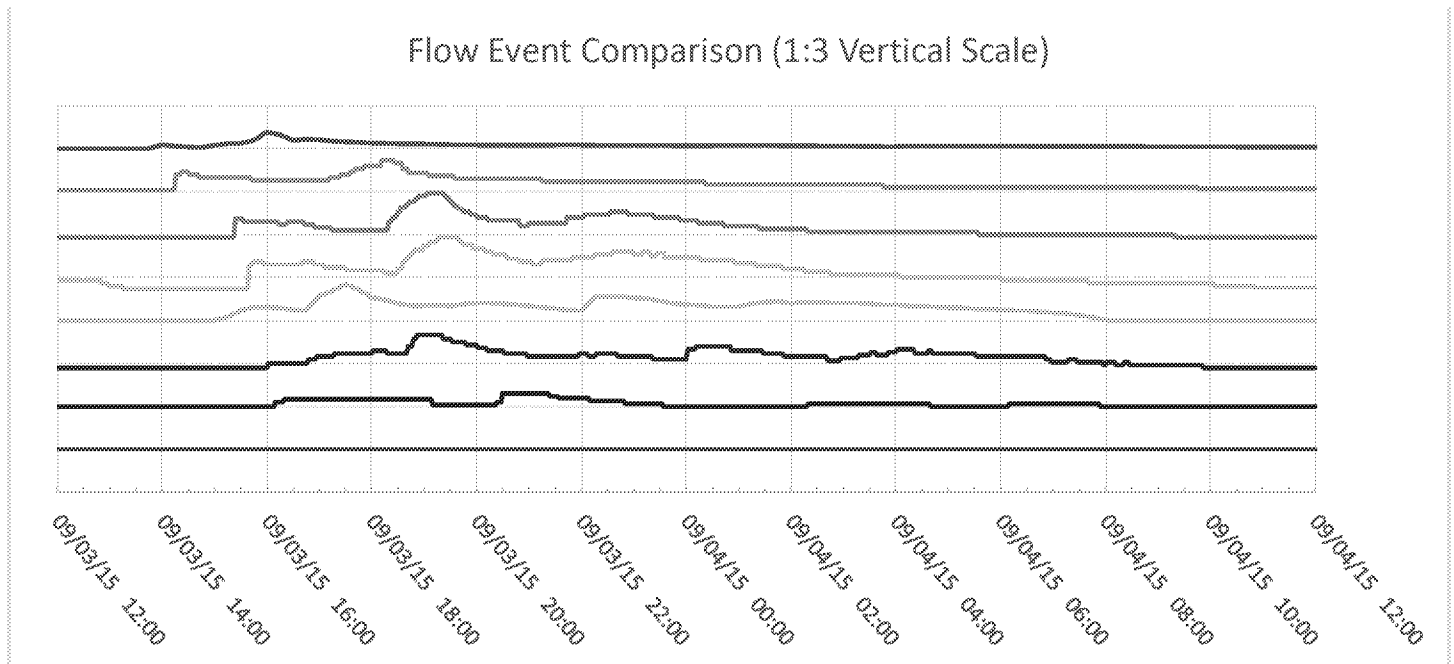
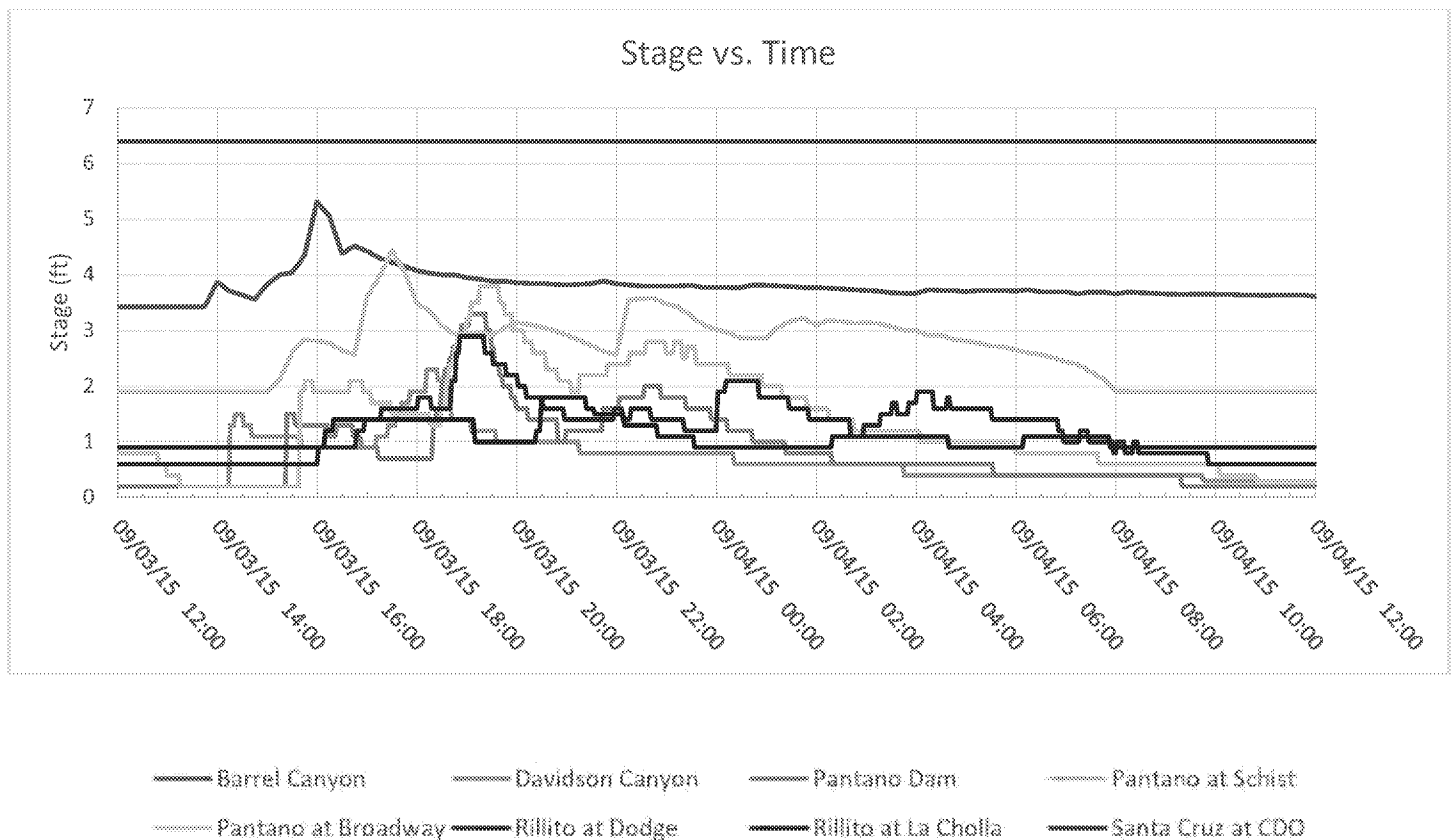


24-hour Qualitative Precipitation Estimate: Recorded at 7:30 AM 8/1/2016

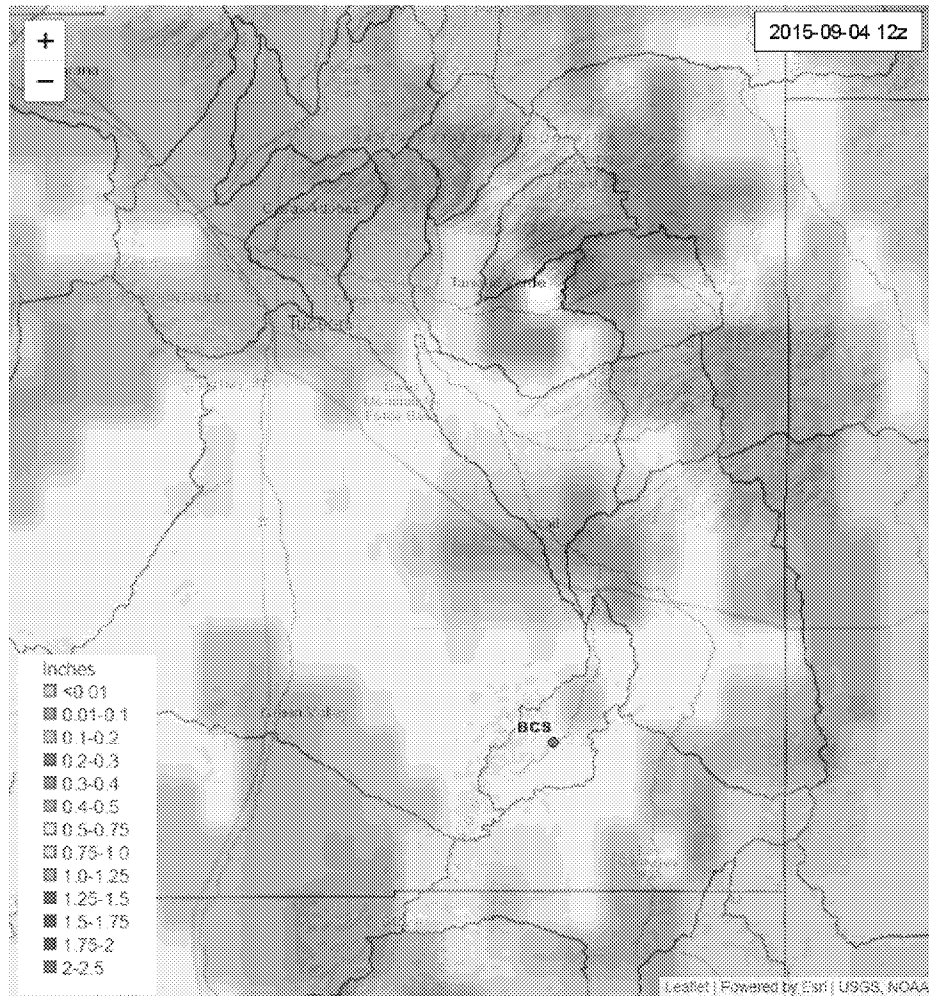
Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita	7/31/2016	31.3			Moderate Drought
Pima County 4313 - Davidson Canyon near I-10	7/31/2016	1			Moderate Drought
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	7/31/2016	970.8			Moderate Drought
Pima County 4263 - Pantano Wash at Schist	7/31/2016	710			Moderate Drought
USGS 09485450 - Pantano Wash at Broadway	8/1/2016	2950			Moderate Drought
Pima County 2353 - Rillito Creek above Dodge Blvd	8/1/2016	2439			Moderate Drought
Pima County 2363 - Rillito Creek at La Cholla Blvd	8/1/2016	1750			Moderate Drought
Pima County 6013 - Santa Cruz below CDO Wash	8/1/2016	6240			Moderate Drought



3 September 2015





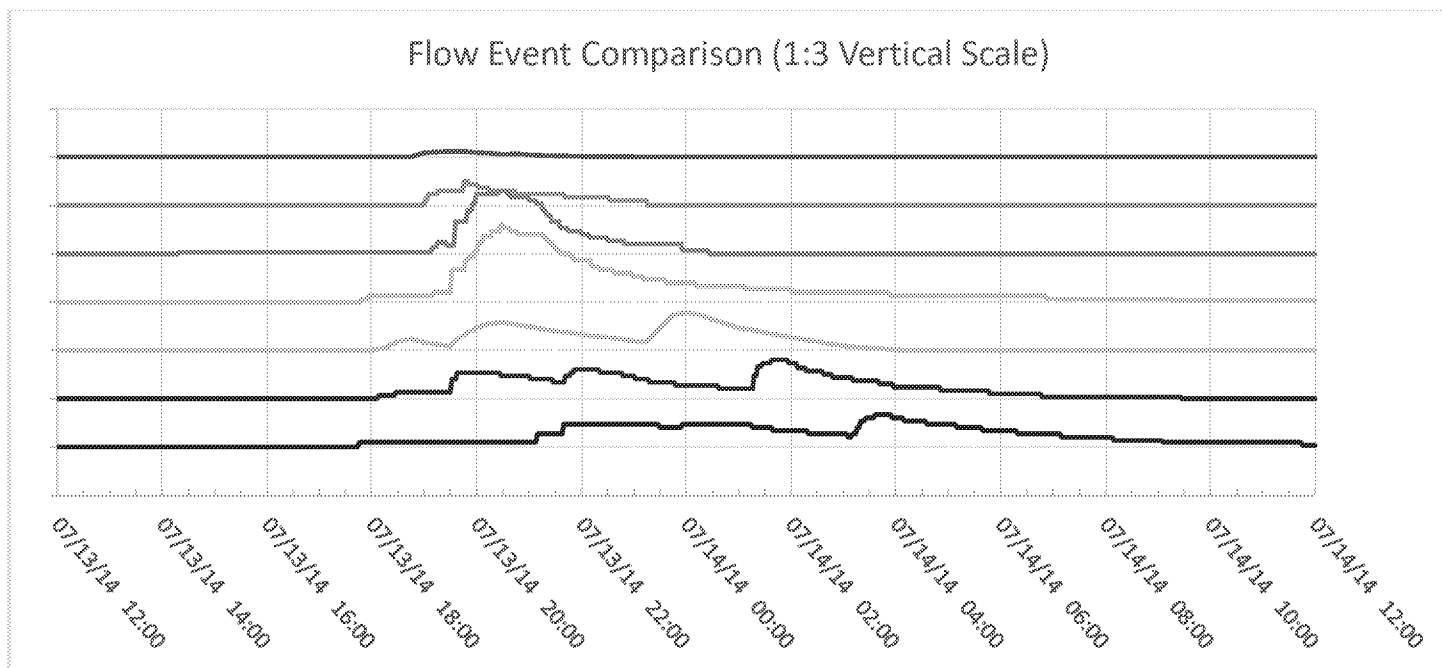
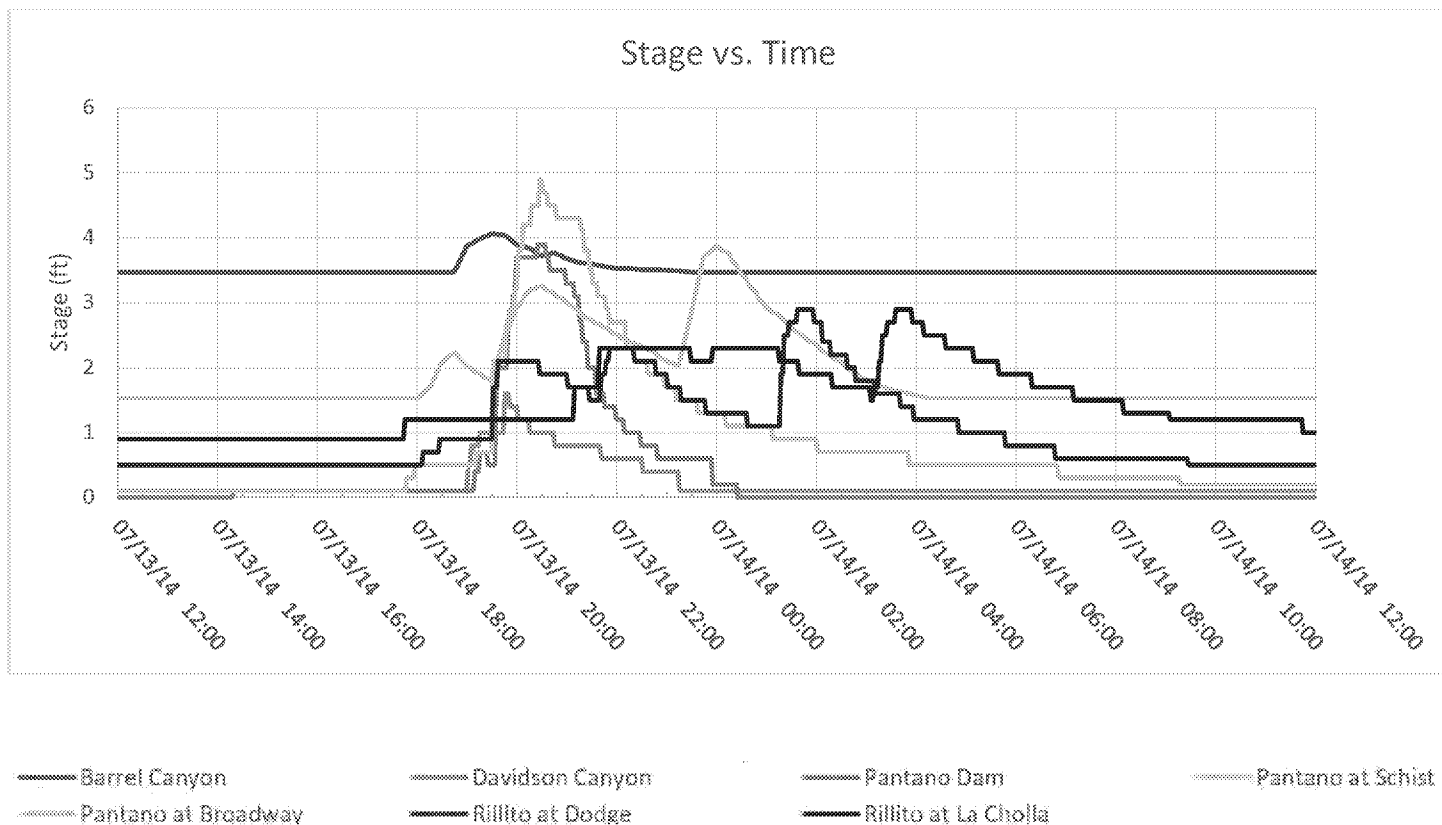


24-hour Qualitative Precipitation Estimate: Recorded at 5:00 AM 9/4/2015

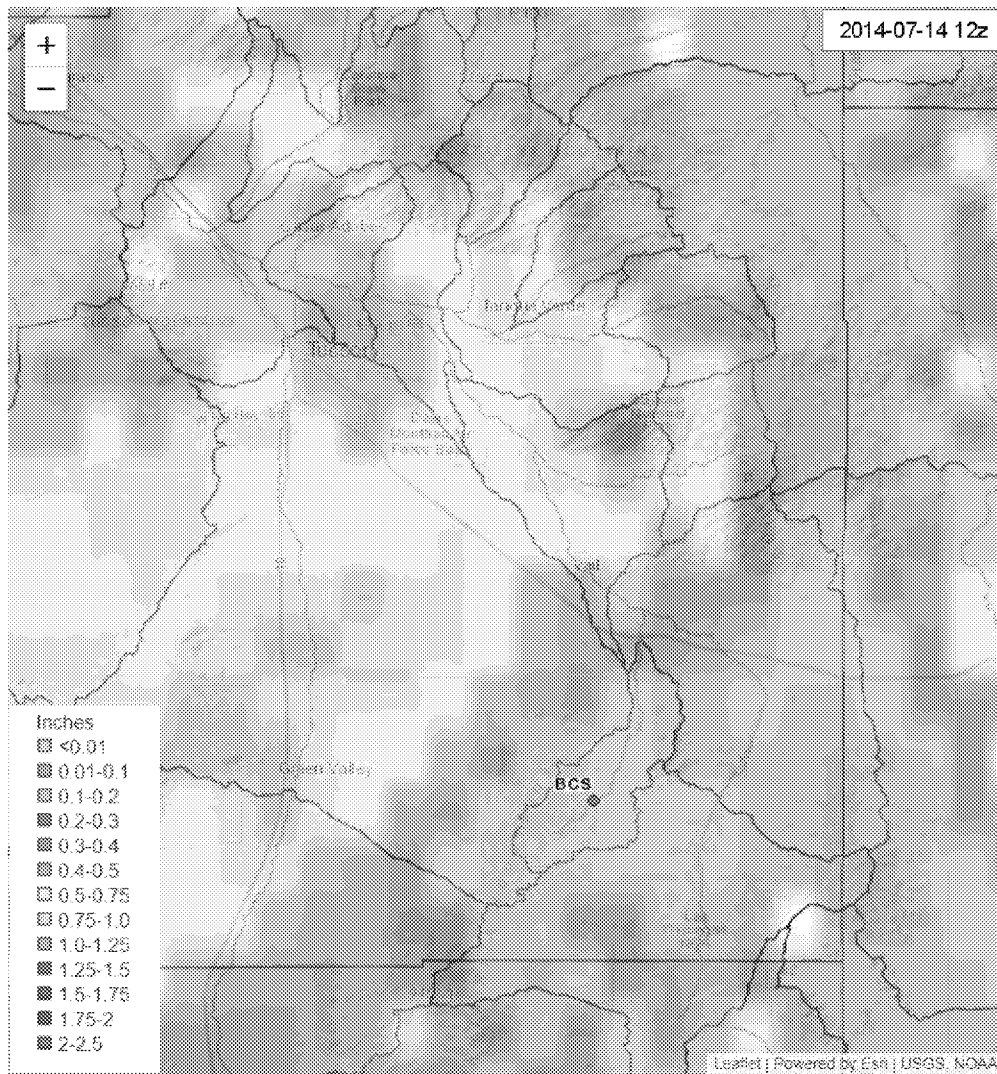
Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita	9/3/2015	528			Mid-Range
Pima County 4313 - Davidson Canyon near I-10	9/3/2015	1525			Mid-Range
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	9/3/2015	1400			Mid-Range
Pima County 4263 - Pantano Wash at Schist	9/3/2015	1220			Mid-Range
USGS 09485450 - Pantano Wash at Broadway	9/3/2015	0			Mid-Range
Pima County 2353 - Rillito Creek above Dodge Blvd	9/4/2015	1547			Mid-Range
Pima County 2363 - Rillito Creek at La Cholla Blvd	9/4/2015	211			Mid-Range
Pima County 6013 - Santa Cruz below CDO Wash	N/A	1			Mid-Range



13 July 2014





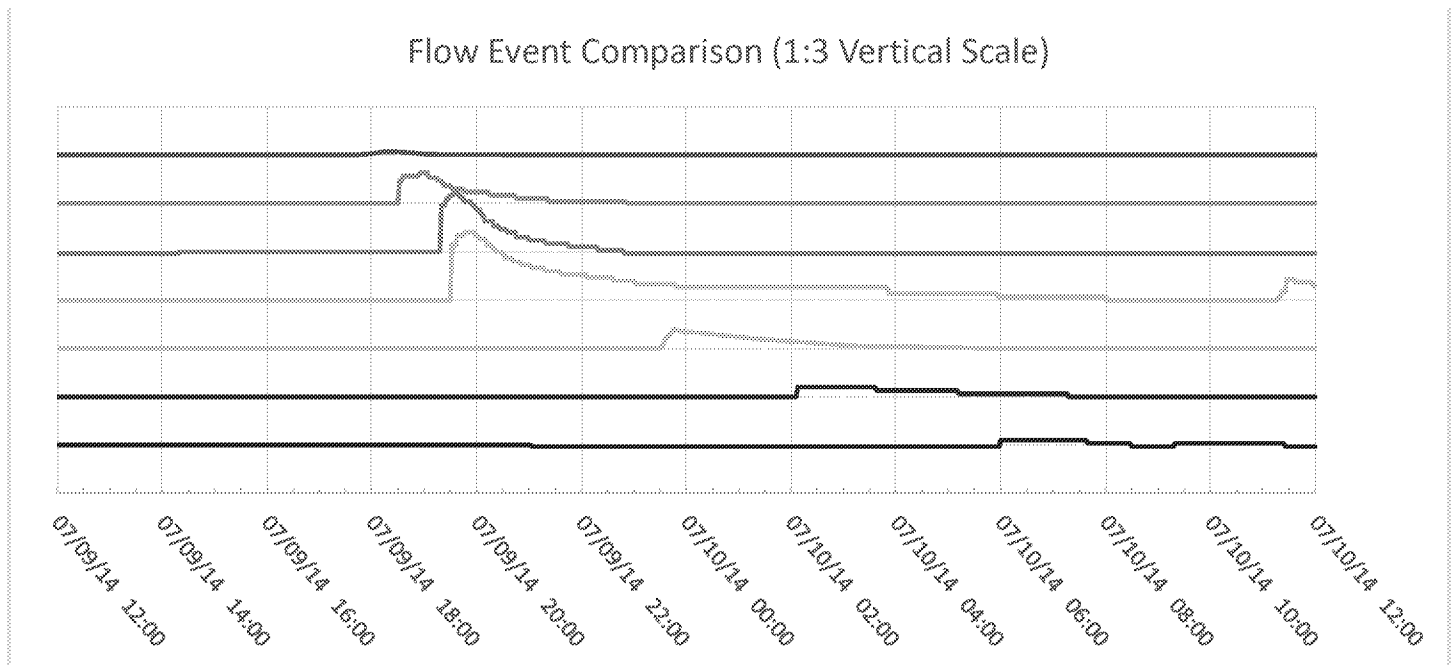
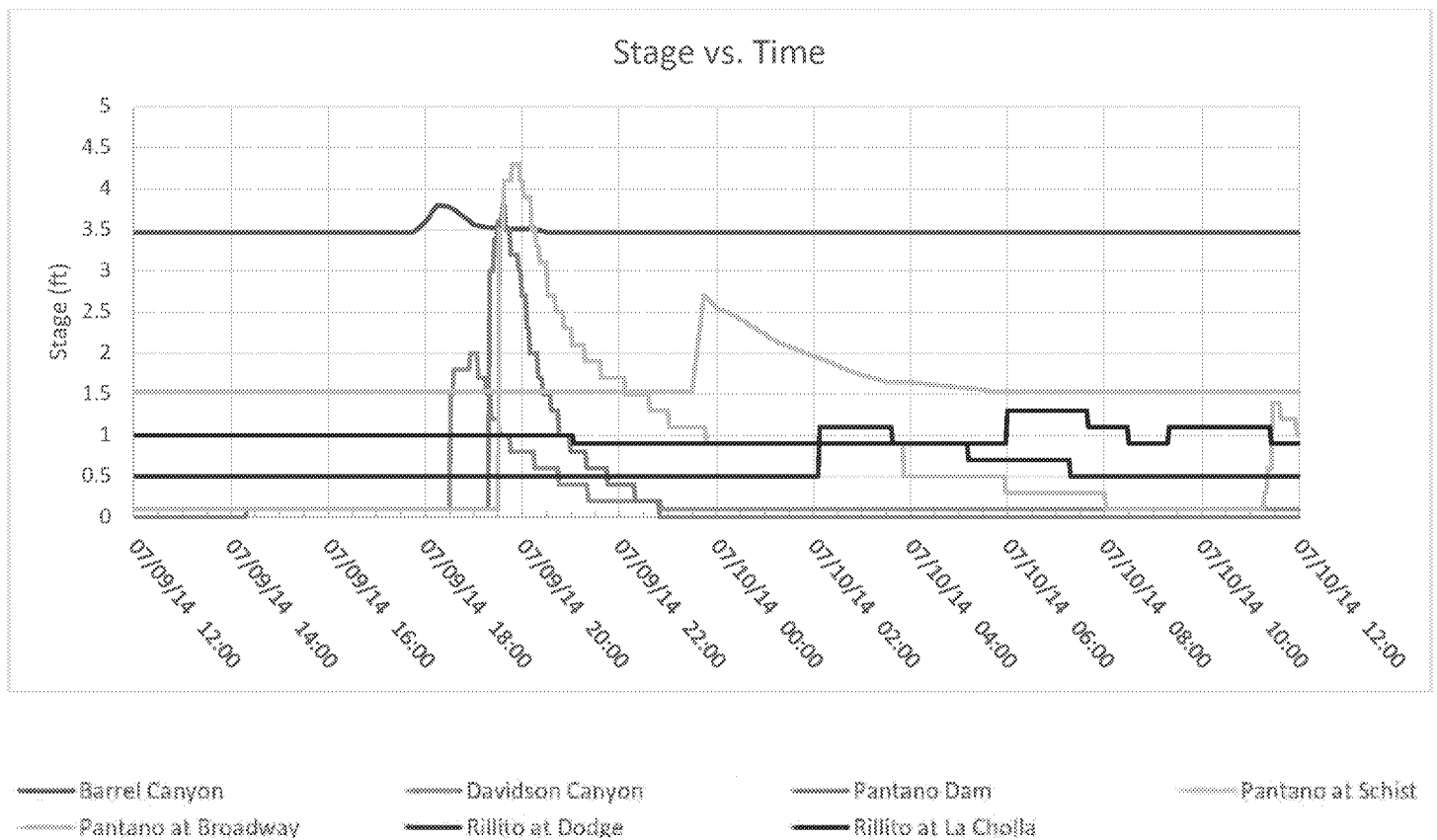


24-hour Qualitative Precipitation Estimate: Recorded at 5:00 AM 7/14/2014

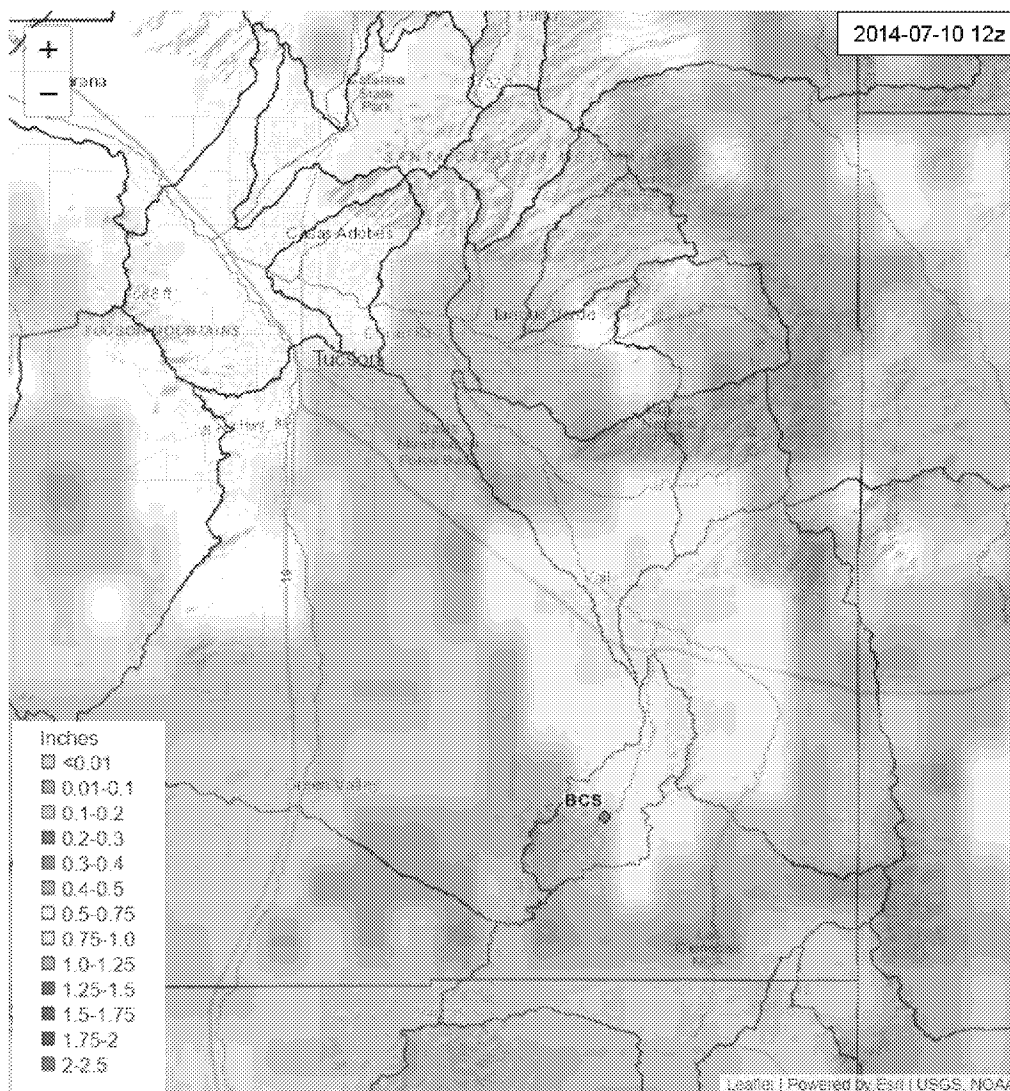
Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita	7/13/2014	69.8			Extreme Drought
Pima County 4313 - Davidson Canyon near I-10	7/13/2014	853			Extreme Drought
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	7/13/2014	2023			Extreme Drought
Pima County 4263 - Pantano Wash at Schist	7/13/2014	2094			Extreme Drought
USGS 09485450 - Pantano Wash at Broadway	7/14/2014	1560			Extreme Drought
Pima County 2353 - Rillito Creek above Dodge Blvd	7/14/2014	1547			Extreme Drought
Pima County 2363 - Rillito Creek at La Cholla Blvd	7/14/2014	913			Extreme Drought



9 July 2014



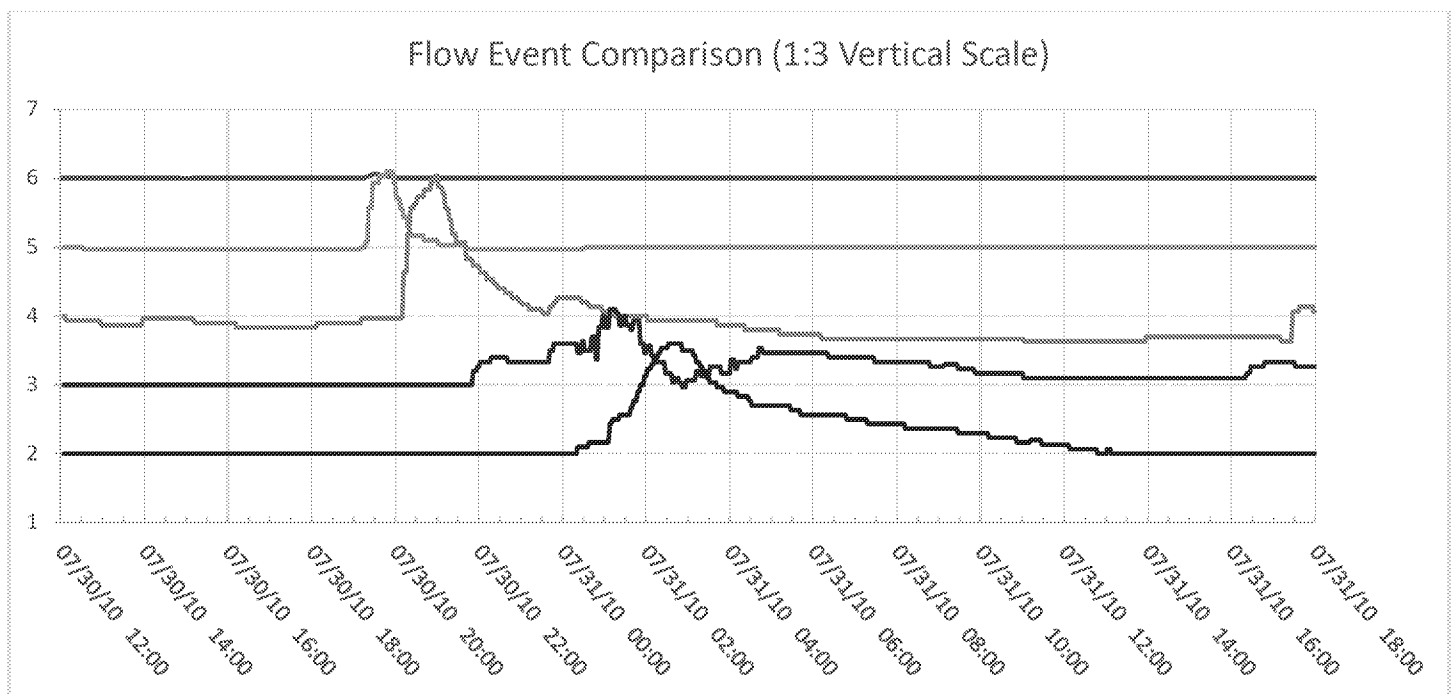
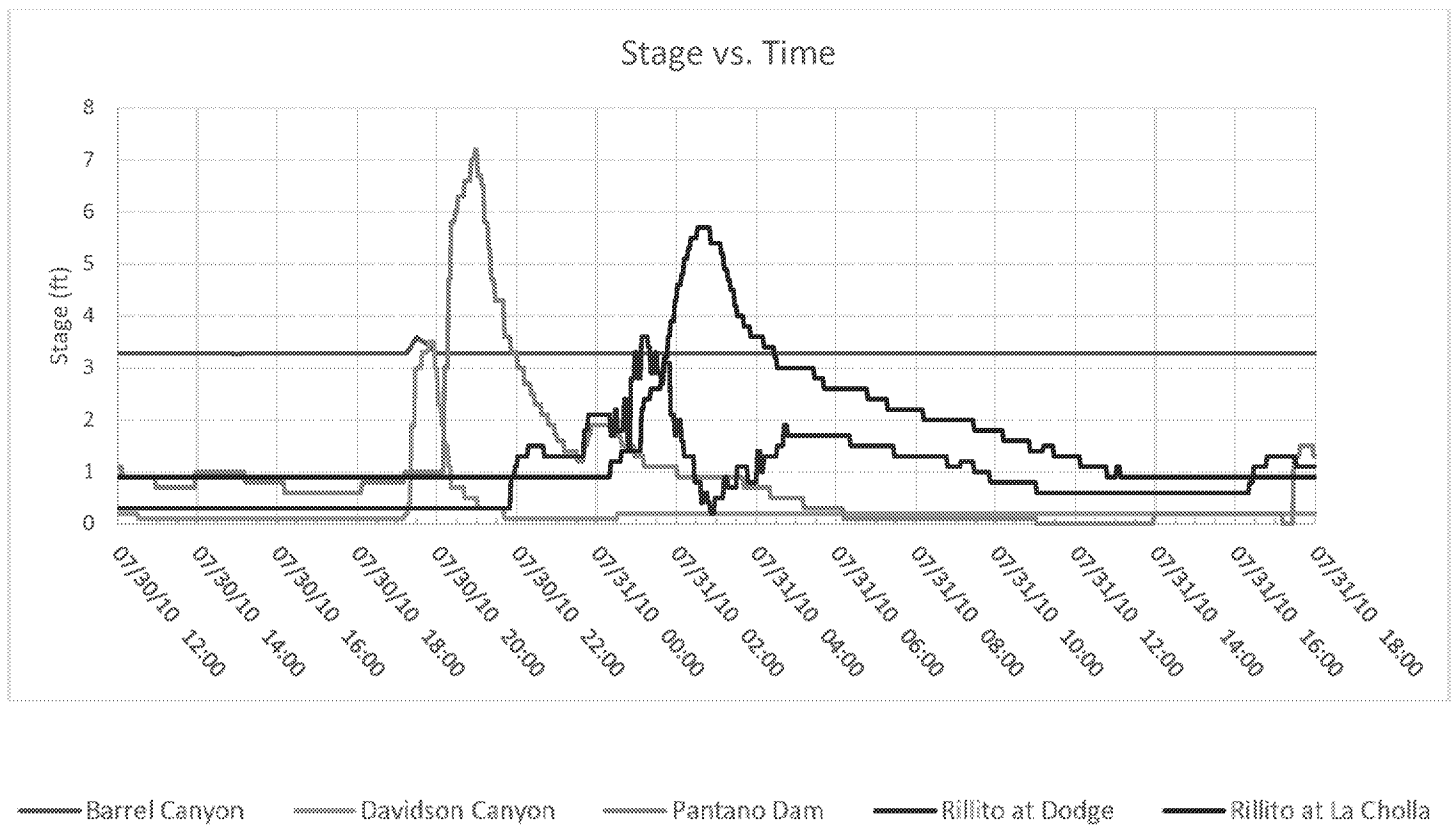




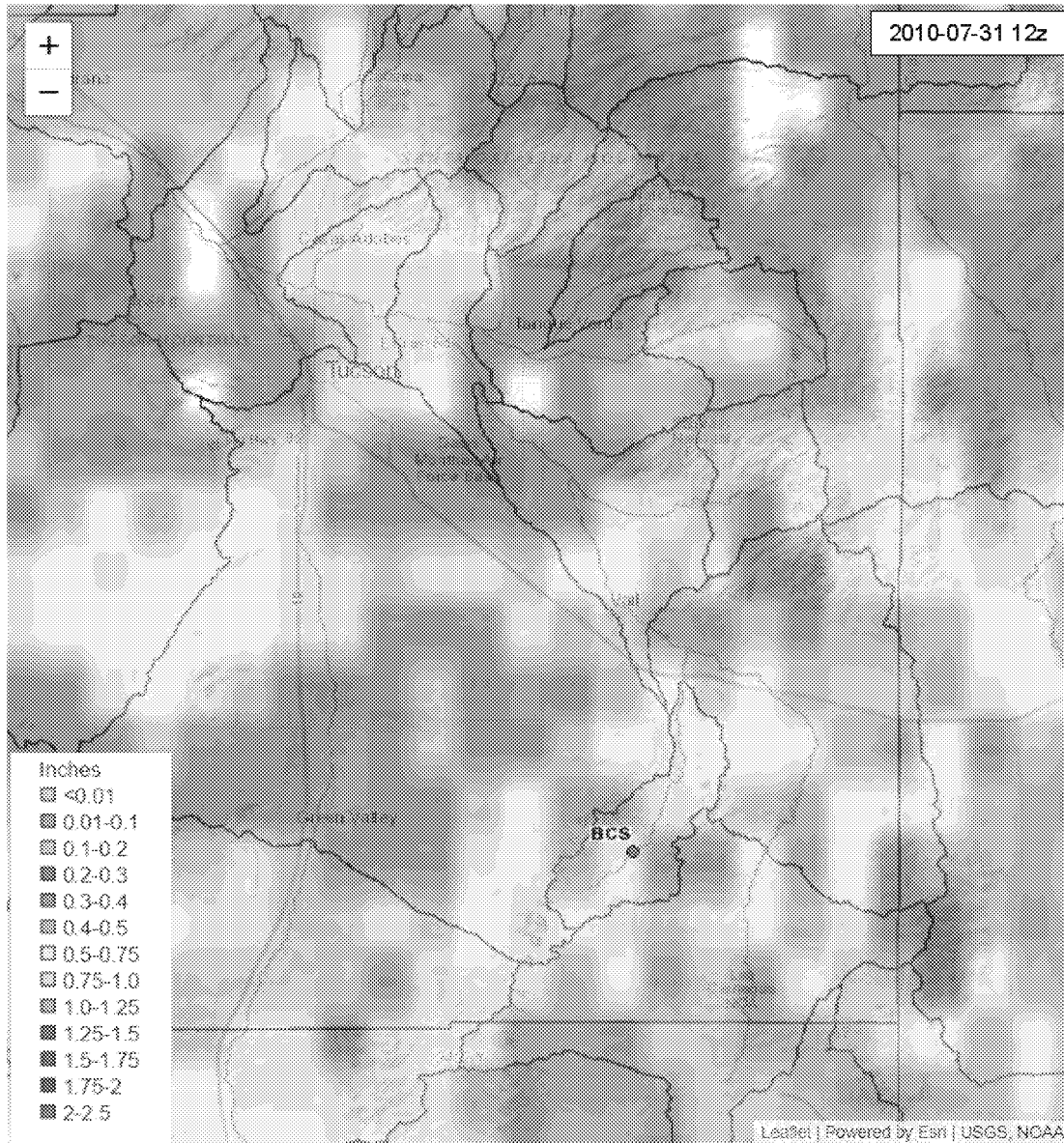
24-hour Qualitative Precipitation Estimate: Recorded at 5:00 AM 7/10/14

Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita	7/9/2014	10.7			Extreme Drought
Pima County 4313 - Davidson Canyon near I-10	7/9/2014	1210			Extreme Drought
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	7/9/2014	1912			Extreme Drought
Pima County 4263 - Pantano Wash at Schist	7/9/2014	1592			Extreme Drought
USGS 09485450 - Pantano Wash at Broadway	7/9/2014	400			Extreme Drought
Pima County 2353 - Rillito Creek above Dodge Blvd	7/10/2014	227			Extreme Drought
Pima County 2363 - Rillito Creek at La Cholla Blvd	7/10/2014	136			Extreme Drought









24-hour Qualitative Precipitation Estimate: Recorded at 5:00 AM 7/31/2010

Stream Gauge	Date	Peak Flow (cfs)	APT Index (score)	Season	Palmer Drought Index
USGS 09484580 - Barrel Canyon near Sonoita	7/30/2010	4.25			Moderately Moist
Pima County 4313 - Davidson Canyon near I-10	7/30/2010	2855			Moderately Moist
Pima County 4253 - Pantano Wash near Vail (Pantano Dam)	7/30/2010	6820			Moderately Moist
Pima County 2353 - Rillito Creek above Dodge Blvd	7/31/2010	4690			Moderately Moist
Pima County 2363 - Rillito Creek at La Cholla Blvd	7/31/2010	7285			Moderately Moist